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ABSTRACT

Proceedings of the 1981 CAUSE conference include both professional and vendor presentations. Track 1, on decision support systems, examines such areas as system design, the EDUCOM Financial Planning Model System (EFPM), the evolution of support systems, and a Mississippi approach. Track 2, "Managing the Information Systems Resource," focuses on the nature of managerial work, the socio-technical approach to designing an information system, recruitment of computer services personnel, computer center performance measurement, and management success formula. The third track, "The Emerging Technology," discusses: VISICALC budgeting, modeling with VISICALC and EFPM, word processing at Carnegie-Mellon University, electronic mail, and improving financial aid delivery through an electronic delivery system. Track 4, "Small College Information Systems," examines: an online fund raising system for a private university, the college as a knowledge organization, support systems for private college admissions, personnel/payroll entity-relationship model, and management information systems (MIS) at a small college. In track 5 on applications, the following are covered: user control management at Florida, strategic planning as a new role for MIS, table driven general ledger system for fund accounting, university stores, improving systems development at Clemson University, and course offerings as a university resource at the University of Georgia. Track 6, "Professional Techniques," includes: a wholistic approach to applications development, automating the clerical control function in data processing, evaluation criteria for higher education computing, the systems analyst role, finding and keeping performance-oriented individuals, and general methodology and linear model for planning and evaluation. Vendor presentations are from: Integral Systems, Inc.; Arthur D. Little; and CBORD Group (universal campus ID system); Digital Equipment Corp..; IBM Corp.; Management Science America, Inc.; National Computer Systems, Inc.; Pansophic Systems, Inc.; Peat,

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People: Creativity and Quality with Technology

Proceedings of the
1981 CAUSE National Conference

December 1981
St. Louis, Missouri

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INTRODUCTION

The theme for this year's Conference was "People: Creativity and Quality with Technology." The individual track themes supported the Conference theme: TRACK I: Issues in Higher Education--Decision Support Systems; TRACK II: Managing the Information Systems Resource; TRACK III: The Emerging Technology; TRACK IV: Small College Information Systems; TRACK V: Great Applications; and TRACK VI: Professional Techniques. Within these tracks, 42 presentations were made. In addition, the Conference offered 13 presentations by vendors and three major general session addresses. The featured speakers were selected in an attempt to allow conferees to broaden their values about higher education. Last, but not least, the Conference featured a Current Issues Forum, where conferees were able to express their views and ask questions of the panelists.

CAUSE 81 also celebrated the 10th anniversary of CAUSE as an incorporated association with an executive office. After an elegant anniversary banquet, a brief program commemorated the contributions of past CAUSE presidents and the growth of CAUSE during its first decade since incorporation.

We hope these Proceedings will provide a continuing reference to the many activities of the Conference and the CAUSE organization. We also hope you will benefit from sharing the experiences of others and thus become more effective in the development, use and management of information systems at your institution.

We encourage you to use CAUSE to complement your individual efforts at strengthening your organization's management capabilities through improved information systems.

CAUSE, the Professional Association for Development, Use and Management of Information Systems in Higher Education, helps member institutions strengthen their management capabilities through improved information systems.

Formerly known as the College and University Systems Exchange, CAUSE first organized as a volunteer association in 1962 and incorporated in 1971 with 25 charter member institutions. That same year the CAUSE National Office opened in Boulder, Colorado with a professional staff to serve the membership. Today the organization has 370 member institutions with 1,350 member representatives and continues to grow.

CAUSE provides member institutions with many services to increase the effectiveness of their administrative information systems: organization publications such as a magazine, newsletter, and monograph series, the CAUSE Directory and the Conference Proceedings; a Professional Development Program offering workshops and seminars on subjects related to information systems in higher education; consulting services to review ADP organizations and management plans; the Exchange Library to provide a clearinghouse for non-proprietary information systems contributed by members; and an Information Request Service to locate specific systems or information.

The CAUSE National Conference is an excellent forum for the exchange of ideas, systems and experiences among the many speakers and participants. The Proceedings provide a continuing reference to the many activities of the Conference.

R. Brian Walsh
1981 Conference Chairman

Martin B. Solomon
1981 Conference Vice-Chairman

Charles R. Thomas
Executive Director
CAUSE

ACKNOWLEDGMENTS

The success of the CAUSE National Conference is due entirely to the contributions of people and supporting organizations. Although it would be impossible to identify all of the people who contributed time and effort to the planning and operation of the 1981 Conference, several deserve special note.

The Program Committee, with the CAUSE Staff, spent many hours to produce an effective and smoothly run conference. Their enthusiasm, efforts and the support of their institutions are gratefully acknowledged.

1981 CAUSE NATIONAL CONFERENCE PROGRAM COMMITTEE

Seated from left to right: Martha A. Fields, State University System of Florida; Jane Knight, CAUSE; Deborah K. Smith, CAUSE; Sallie R. Fulsom, Seminole Junior College, Oklahoma. Standing from left to right: R. Brian Walsh, University of Notre Dame, Conference Chairman; Martin B. Solomon, University of Kentucky, Conference Vice Chairman; Warren H. Groff, North Central Technical College, Ohio; Charles R. Thomas, CAUSE; William G. Verbrugge, Ball State University; Lawrence Westermeyer, University of Missouri; and Michael M. Roberts, Stanford University. Absent from the photo: Joseph E. Hayes, University of Colorado and Thomas W. West and Ray Clark, California State University.

The logistics of conference registration were efficiently supervised by Jane Knight of the CAUSE Staff with the assistance of Joyce Dakter of the University of Illinois and Pat Stewart of the University of Missouri. Their efforts and friendly smiles are appreciated.

The advance preparation for the Conference and the publication of the Proceedings require a great deal of professional expertise and effort. The contributions of Julia A. Rudy and Deborah K. Smith of the CAUSE Staff are appreciated. Special thanks also to Patty Angerer for her efforts in creating the photo montages displayed during the Anniversary Banquet.

The continuing support of the CAUSE Board of Directors and the membership they represent is also gratefully acknowledged.

1981 CAUSE BOARD OF DIRECTORS

Seated from left to right: Gary D. Devine, University of Colorado; Dewana P. Green, University of Alabama; Charles R. Thomas, CAUSE; Mary Jo Caster, University of Connecticut. Standing from left to right: Charles A. Brooks, South Carolina Commission on Higher Education; Wade Harris, Eastern Washington University; James L. Strom, Clemson University; Ronald J. Langley, California State University, Long Beach; Joseph A. Catrambone, University of Illinois; Robert J. Sanders, Community College of Denver; and William E. Walden, University of New Mexico.

GENERAL SESSIONS

CAUSE 81 was highlighted by a number of special General Sessions which brought conferees together periodically throughout the Conference to hear presentations on subjects of broad interest and concern to all. This year's Conference featured the second annual CAUSE Awards Luncheon, where recipients of the CAUSE Recognition Awards and *CAUSE/EFFECT* Contributor of the Year Award were honored, as well as awards presented to the 1981 CAUSE National Conference Program Committee and others in the organization for their service to CAUSE in the past year.

KEYNOTE ADDRESS

THE CEO'S VIEW OF ADMINISTRATIVE SYSTEMS

Arnold R. Weber
President
University of Colorado

KEYNOTE ADDRESS

Arnold Weber, University of Colorado President, shared his view of administrative information systems as a chief executive officer in an informative keynote address for CAUSE 81. Since his CAUSE appearance, Dr. Weber has been named by President Reagan to the newly established National Productivity Advisory Committee.

R. Brian Walsh, CAUSE 81 Chairman, and Dr. Weber

COMMUNICATION BETWEEN THE SEXES

Niki Scott
Syndicated Columnist
"The Working Woman"

LUNCHEON ADDRESS

Niki Scott, nationally syndicated author of "The Working Woman," a column which appears in nearly 200 newspapers throughout the country, presented a lively luncheon address on the subject of "Communication Between the Sexes," followed by a question and answer session reflecting the varied views of conferees on the subject.

THE THIRD TECHNOLOGICAL REVOLUTION: THE IMPACT OF COMPUTERS AND COMMUNICATION

THURSDAY MORNING ADDRESS

Daniel Bell, Henry Ford II Professor of Social Science at Harvard University, presented an enlightening view of the impact of computers and communications on society.

Daniel Bell
Harvard University

CURRENT ISSUES FORUM

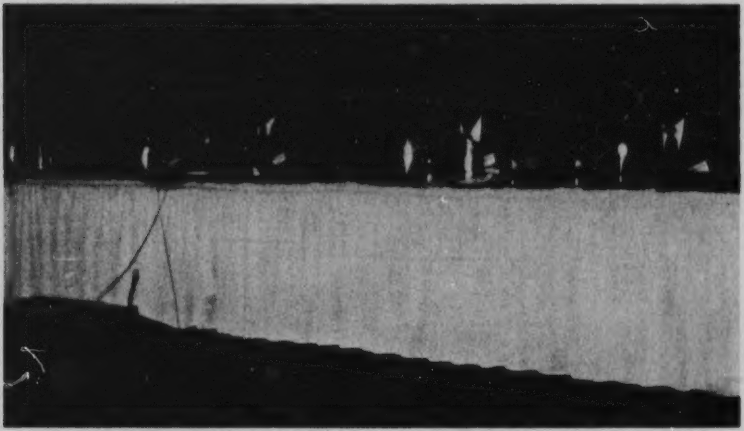
DISTRIBUTION OF THE COMPUTING RESOURCE

Moderator Martin Solomon

FRIDAY CLOSING SESSION

The Conference closed with a stimulating forum on a topic of great concern to all college and university administrative information systems professionals: Distribution of the Computing Resource.

Panel members James L. Morgan, Wayne Ostendorf, Patricia Skarulis, Mack Usher and Moderator Martin Solomon discussed such sub-topics as office automation, microcomputers as terminals, and telecommunications. The format allowed substantial audience participation, interaction and discussion.



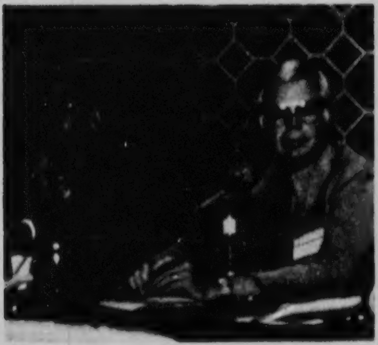
Wayne Ostendorf
Iowa State University

Pat Skarulis
Princeton University

William Mack Usher
Oklahoma State University

James L. Morgan
State University System of Florida

Martin B. Solomon
University of Kentucky



AWARDS LUNCHEON

Program Chairman R. Brian Walsh presented tokens of appreciation to members of the 1981 Program Committee and Registration Staff. CAUSE President Dewana P. Green presented the second annual CAUSE Recognition Awards to John F. Chaney for Professional Excellence and David J. Lyons for Exemplary Leadership, and the first annual CAUSE/EFFECT Contributor of the Year Award to Robert Robinson. President Green also introduced the three new members of the CAUSE Board of Directors and the new CAUSE officers. Retiring Board members were awarded Certificates of Appreciation.

Outgoing CAUSE President, Dewana P. Green, presents the gavel to newly-elected President Ronald J. Langley.

1982 CAUSE President Ronald J. Langley presents outgoing President, Dewana P. Green, the CAUSE President's Plaque.

CAUSE 81 Program Committee members were recognized for their contribution to the success of the 1981 CAUSE National Conference. Each received a gift of appreciation from Conference Chairman, R. Brian Walsh.

CAUSE 81 Conference Chairman, R. Brian Walsh, accepts his gift of appreciation from President Green.

RECOGNITION AWARDS

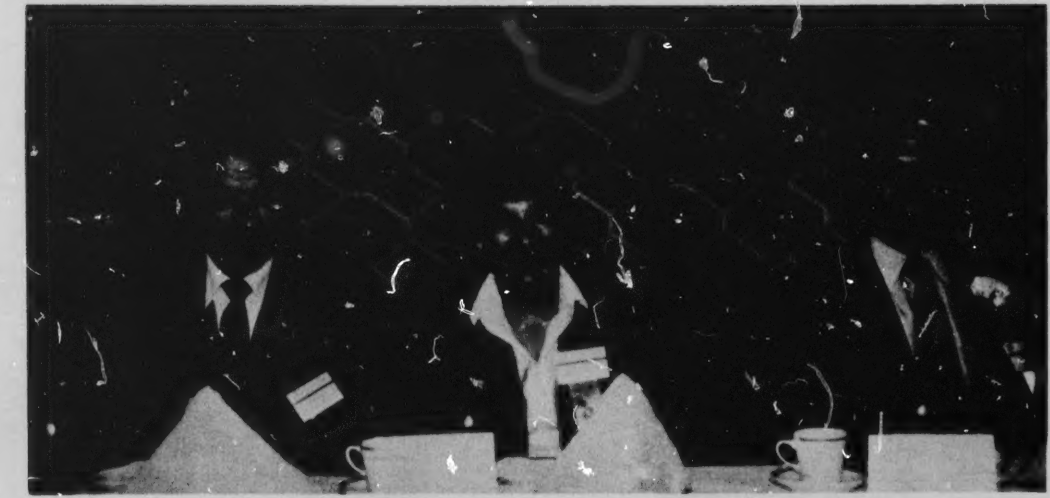
President Green presents David J. Lyons, The Rockefeller University, the CAUSE Award for Exemplary Leadership for his advocacy and support of administrative information systems in higher education at his university and at the national level.

President Green presents John F. Chaney the CAUSE Award for Professional Excellence in the field of administrative information systems in higher education at the university and national level.

CAUSE/EFFECT CONTRIBUTOR OF THE YEAR

President Green presents __CAUSE/EFFECT__ Contributor of the Year, Robert J. Robinson, his award plaque . . . . . .

. . . . and $500 in cash.



New members of the CAUSE Board of Directors, from left to right: Charles H. Naginey, University of Pennsylvania; Dorothy J. Hopkin, Michigan State University; and A. Wayne Donald, Virginia Tech.

Gary D. Devine
University of Colorado

Retiring
Board
Members

Mary Jo Caster
University of Connecticut

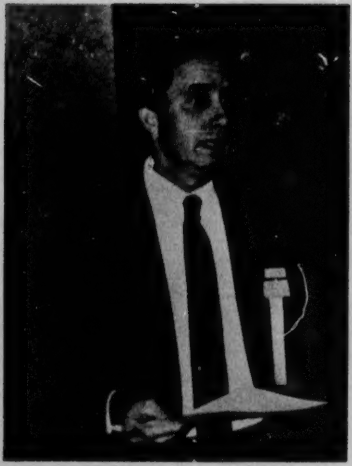
Dewana P. Green presents a certificate of appreciation to retiring Board member and 1981 CAUSE Vice President, Gary D. Devine, University of Colorado, for his service to CAUSE.

PROFESSIONAL PRESENTATIONS

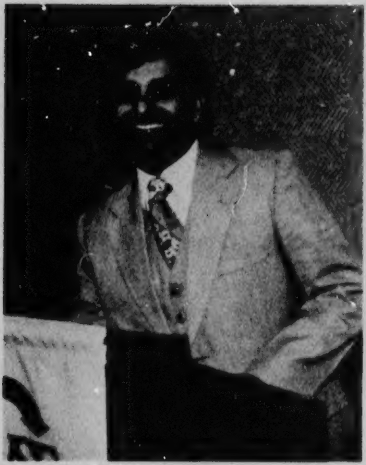
The CAUSE 81 Conference theme was addressed through 42 professional presentations in six subject tracks (see Table of Contents) as well as a number of vendor presentations.

TRACK I
ISSUES IN HIGHER EDUCATION: DECISION SUPPORT SYSTEMS

Coordinator:
Michael M. Roberts
Stanford University



Malcolm B. Lightsey
Board of Trustees of State Institutions of Higher Learning
State of Mississippi



Vinod Chachra
Virginia Tech

Ellen Chaffee
NCHEMS

ANATOMY OF A DECISION SUPPORT SYSTEM

Vinod Chachra
Robert C. Heterick
Virginia Polytechnic Institute & State University
Blacksburg, Virginia

ABSTRACT

Decision Support Systems must of necessity focus on the *ad hoc,* unstructured problem solving environment where the role of the computer system in the process is always supplemental, never primary. The Data Processing Systems of the Sixties have matured into what we now term Management Information Systems, addressing most of the problems of operational level management and many of the problems of middle management. Further maturation to the level of Decision Support Systems will require overcoming fundamental structural deficiencies in both the architecture of current computer-communication systems and the functional design of software packages. This paper addresses the Decision Support System environment, the functional requirements of a Decision Support System, the architectural requirements of the computer systems and communications network necessary to support a Decision Support System and suggests the changes in today's computing environment that will be necessary to implement Decision Support Systems.

DECISION SUPPORT SYSTEMS

The impact of the computer on problem solving is generally alluded to in the literature, but not made manifestly fundamental to the problem solving process. For planners and managers the computer embodies the most significant research and application tool for the support of the decision process ever possessed by their professions. To achieve its full impact on the problem solving process these professionals need to understand and internalize the computer as a basic tool in their decision processes. This internalization of the computer on the part of the decision maker can only be achieved when the computer is used interactively with a terse, concise, consistent notation that perhaps suggests, but does not direct or control, the decision process of the user.

> *"The purpose of computing is insight, not numbers."*
> *R.W. Hamming*

It is clear that the field termed cybernetics by Norbert Weiner[1] is destined to significantly alter our perception of how best to engage in that ill-defined activity we call problem solving, or decision making. Computer technology is not a panacea for the myriad of problems that confront the decision maker. It is our contention that problem solving is a rational, learnable activity rather than a visceral reaction to some mild hallucinogen, or the automatic application of obscure theorems from advanced mathematics. The paradigms of the problem solving process can be internalized if sufficient attention is given to the development of insightful surrogates, suitable for formal analysis. Further, decision making is an intensely personal activity. We reject out of hand the effort to create sophisticated software to be used by the novice as a black box in the problem solving process. The tractability of a problem will be influenced by our perception of it. Interesting problems generally do not have unique solutions. In fact, they generally admit of infinitely many solutions. The role of the decision maker is to evaluate and choose amongst solutions. The problem solver needs to identify the paradigm problems and to find suitable, generally simplier, surrogates which have unique or tightly bounded solutions and which are capable of providing insight about the "real problem".

---

[1] Norbert Weiner, Cybernetics: or Control and Communication in the Animal and the Machine, The MIT Press, Cambridge, MA, 1948

> *"A system is more than the sum of its parts; it is an indivisable whole. It loses its essential properties when it is taken apart."*
> *Russell Ackoff*[2]

To this end the decision process involves constructing models. Models might be classified as either iconic or analogic. This distinction probably has little more than the force of Aristotlean logic to recommend it, other than it may help perceive how the computer properly fits into the decision making process. Iconic models may be considered to be those image generating, emotional, intuitive and ambiguous forms such as natural language, diagrams and fuzzy sketches. Analog models are measureable, quantifiable, rule manipulated, rational forms such as mathematical notations, mappings and drawings. Both are necessary to the decision making process. Decisions are generally expedited when the models are analogic rather than iconic. Few, if any, interesting problems can be solved completely by the application of analogic models. The problem solving process is carried out by the alternating application of iconic and analogic models. When the limit of formal analysis is confronted we turn to some iconic model for "inspiration" or a fresh perception of a method of attack. A Decision Support System needs to facilitate and complement this man-machine symbiosis. The iconic aspect of problem solving is one of the reasons why graphics is so important an aspect of Decision Support Systems. Both the man and the machine are part of a single system wherein the fundamental synergy is lost when they fail to act in concert.

---

[2] Russell Ackoff, Science in the Systems Age, Wharton Quarterly, Volume 7, Number 2.

> ▌ *"An executive support system achieves the coupling of an individual's intellectual resources with those of the machine."*
> *G.R. Wagner*[3]

Because decision making is a highly personalized process, the Decision Support System needs to avoid capturing the decision maker in a fixed, sequential process, but rather needs to facilitate unstructured probing of surrogate problems never knowing in which direction the next salient will be breached. Confronted with the same verbalization of a problem and the same set of available information, no two decision makers can be expected to follow the same route to a decision, nor in fact, even to arrive at the same decision. The Decision Support System (DSS) must facilitate this *ad hoc* approach to problem solving, it must never inhibit it. The value system brought to the problem is highly personal and subjective, hence the utility functions present in any optimizing analytical routines in the DSS need to be defined "on the fly" by the decision maker. Information accessed by the decision maker needs to be simply structured and the availability of information, as well as the information itself, needs to be accessable via a query structure in the DSS. The DSS needs to be capable of personalization, modification and augmentation by the decision maker if it is to achieve the coupling of the individual with the machine.

---

[3] G.R. Wagner, Optimizing Decision Support Systems, Datamation, May 1980, page 209

"All Cretans are liars."
Epimenides

The decision making process is poorly understood and no amount of computational support can substitute for the basic research so desperately needed in the field of human problem solving. It is clear that the process is holistic rather than reductionistic so that a reductionistic system of computer algorithms cannot substitute for the whole process. The fuller understanding of the problem solving process is properly part of the domain of artificial intelligence research. The role of the DSS must be seen in addressing the pragmatic activity referred to by Sir Karl Popper[4] as conjecture-refutation. The DSS must help the decision maker unfold more rapidly the consequences of his or her conjectures, permitting both a deeper and broader investigation of potential solutions subject to the constraints of time and money. The DSS needs to adapt itself to the realities of the self-referential[5] nature of the problem solver's process -- a process which includes continual re-definition of the problem as potential solutions are brought into sharper focus.

FUNCTIONAL REQUIREMENTS

The value of a DSS is directly proportional to the information sources to which it has access, and the ease by which these sources may be accessed and manipulated. The problem solver tends to think most comfortably about information structured in two dimensional tables, records and fields if you will. The computer, as an axiomatic device, is most accurately and logically directed by mathematically (axiomatic) based structures. The marriage of relational data base concepts with the DSS is a natural and fortuitous one. Whilst for the sake of computational speed or efficency the storage strategy actually used by the computing machine may take some other form, the user's view of the information should always be relational.

---

[4] Karl R. Popper, Conjectures and Refutations: The Growth of Scientific Knowledge, Harper and Row, New York, 1965

[5] Douglas R. Hofstadter, Godel, Escher, Bach: An Eternal Golden Braid, Random House, Inc., New York, 1979.

"People who don't count, don't count."
Anatole France

Equally important as convenient access is the ability to know of, locate and move between logical relations. Some form of the data diagraph needs to be an integral part of the DSS. The diagraph may be envisioned as a road map with nodes and directed arcs. In its computer embodiment, the nodes may be likened to pages or screens and the arcs as commands that permit movement from node to node. The commands may be either global or local. Global commands may be either searches or requests for processing. Global searches establish an entry point into the system. Global processing helps define the environment in which the analysis is conducted. Local commands may be traverses, moving between related screens of data belonging to different nodes; pagings, which permit moving through the local node; and transactions, which permit modification of the current page or node. The paging commands must facilitate a local memory that allows the user to go back along the search path, recall the current page, or to move to a new page. The data base problem needs to be seen axiomatically rather than hueristically.

"A part of the secret of analysis is the characteristic of using

notation well."

Gottfried Leibnitz

While the decision maker may most often make use of the DSS in a non-procedural manner, the system itself must be built with a procedural language. The language should be terse, powerful and above all, interactive.[6] Additionally, a functional notation allows the user to build new concatenations of the routines of which the system is structured that were never envisioned by the original designer. The DSS should operate in an essentially expanded desk calculator mode, never capturing the user in a subprocess. No procedure or process should be dependent upon the completion of a pre-determined set of previous procedures. All the routines of the system should have explicit results which are available as inputs to any other routine of the system. Global variables should be avoided, suggesting that the system routines all take arguments. Prompting and menus should be used sparingly, if at all -- and then only to provide information along the lines of a help command, not as part of any process or routine of the system. The number of error messages in the DSS should be minimized; syntax, structure, index, domain and undefined value, constituting a sufficient set. The name scope of the user's working space is always a problem. Any reserved names in the DSS should be capable of being changed and customized by the user. The user should be able to add new routines to the system with a minimum of effort, suggesting that he may wish to have some facility with the procedural language base of the DSS. The addition of new procedures should not depend upon understanding the structure of other procedures already part of the system. Graphical routines for constructing line drawings, plots and three dimensional projections (preferably in color) should be part of the primitive function set of the DSS. A comprehensive text editing facility that provides extended storage and retrieval facilities is necessary so that the system can be used not only as a sketchpad, but notebook and file drawer. The system should permit accessing sketchpad and notebook work both chronologically and by key word (KWIC) in the same notation as the analysis routines.

---

[6] Kenneth E. Iverson, Notation as a Tool of Thought, 1979 ACM Turing Award Lecture, Communications of the ACM, Volume 23, Number 8, August 1980.

> *"So, Nat'ralists observe, a Flea Hath smaller Fleas that on him prey. And these have smaller Fleas to bite 'em. And so proceed ad infinitum."*
>
> *Johnathan Swift*

The DSS, in order to achieve its maximum utility, will need to contact alien data. The data may be resident on the host computer of the DSS, but not part of the DSS itself, or it may actually be resident on some other computer system not normally attached by the DSS. Any alien access needs to be dynamic, that is the decision maker should not have to leave the DSS environment in order to access the external information. The access should also be as transparent to the user as possible, not involving the problem solver in unnecessary mazes of access protocols. This will likely have to be accomplished by the addition of a piece of software to the alien system which is capable of responding to the DSS's host request in the form of relational select, project and joins. Some form of standardized header designating the number of records and fields lengths would need to accompany the response. Each system in the network would also need to be able to participate in the data diagraph, responding to a request, perhaps structured as a help command, to indicate the structure of relations it was capable of providing. In relational terminology this would be the number of tuples (records) available and the definition of the domains (fields) making up the relation. The analysis routines of the DSS, while being selectively tailored to the domain of problems encountered by each individual problem solver, all should expect and be prepared to operate on relations from any source, consistent with the header definition. The DSS needs to be defined recursively to admit new levels of the system not originally envisioned.

ARCHITECTURAL REQUIREMENTS

Probably the obvious place to begin reducing architectural constraints is at the decision maker's contact point with the DSS, the terminal. Terminals are obviously getting smarter, but not necessarily wiser. The eight bit byte still constrains the character set to 256 symbols at best. If we wish to minimize terminal dialogue through the use of special characters, and if we wish to produce presentation level graphics in the DSS, it will be necessary to find a way to circumvent this current limit. The character sets themselves need to be capable of being down loaded from the DSS host and efficiently formed at the terminal. The increasing use of proportional fonts places an added architectural hurdle for the next generation of terminals. The current generation of terminals needs to be capable of augmentation with other forms of input such as digitizers, joy sticks and special menu pads.

> *"The medium is the message."*
> *Marshall McLuhan*

The graphics produced at the terminal need to be intermixed with text, much as the problem solver writes, sketches and draws fuzzy diagrams while engaged in the problem solving process. This requirement for the terminal poses a similar requirement on the hard copy output devices. Laser printers are capable of quality superior to conventional typing and approach that of typeset printing. We are still some way from intermixing this quality of text output with graphics, and further still from mixed hard copy color graphics and text. A hierarchy of print quality may not be inappropriate, as the need to maintain a journal or notebook of intermediate conjectures needs only accuracy, not necessarily high quality. The journal, or problem solver's notebook, might be likened to the scientist's laboratory record, the surveyor's field book, or the architect's sketch book. The journal does raise the problem of very large mass stores to facilitate the decision making process. Not only might the problem solver require very large temporary storage of the order of 10^{10} bits or more, but there needs to be an efficient way to index and retrieve information from the journal. Recent work[7] suggests that we have far to go in providing the responsiveness necessary for relatively unstructured searches in relations of this size. The decision maker needs to view the DSS as the medium in which he both thinks about and records his decisions.

> *"If the only tool you have is a hammer, you tend to see every problem as a nail."*
>
> *Abraham Maslow*

The need for large mass stores is complemented by a need for larger primary storage, both real and virtual. The hardware limitation of the four byte (32 bit) word has effectively limited the addressable primary storage to about 16 million locations. It appears that this limitation is actively under attack by several vendors, although at the expense of dramatic violation of the basic hardware architecture. Greatly increased address space, whether real or virtual, should relieve the pressure for the decision maker to manipulate data in any form other than the flat file of the relational scheme. It will however, pose the significant problems of increasing CPU speeds and accesses to secondary storage. The immense difficulty in achieving performance improvements of the magnitude to which we has become accustomed have been clearly delineated by scientists such as Lewis Branscomb.[*] The host back end machine, or the data base front end, may offer the potential for the magnitude of access improvement necessary for very large data bases. The absolute of the speed of light looms all too close when considering dramatic improvement in the cycle speed of the host computer. It is probably the issue of cycle speed rather than storage that will continue to leave the microcomputer outside the domain of potential DSS hosts, at least for the next decade. Increases in the access and cycle speeds are critical in the effort to bring an ever widening circle of problems into the domain of the Decision Support System. For many of the practical applications to which the system may most advantageously be applied we must await, and encourage, the next generation of technology.

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[7] E.F. Codd, A Relational Model of Data for Shared Data Banks, Communications of the ACM, Volume 13, Number 6, June 1970.

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[*] Lewis M. Branscomb, Information: The Ultimate Frontier, Science, Volume 203, pp. 143-147, January 1979.

Information Systems to Support a Decision Process at Stanford

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Abstract

Information is used by participants in any kind of decisionmaking process--rational, bureaucratic, political, or collegial--but its role differs depending on the process used. One of its functions in any process is to lend the appearance of rationality because rational decisionmaking is commonly preferred. Information is vital to a rational decision, and the role of information in that process is quite straightforward--it identifies optimal solutions. When a more rational decision process is desired, information specialists can contribute not only information; they can also contribute to the process in which that information is used, thereby promoting rational decisionmaking.

Stanford University used a rational process to allocate its operating budget during the 1970s. Information specialists contributed to the process in five ways: they provided a chronological skeleton; they brought together people with diverse views; they used information to identify what was not known; they identified goals and motivational concepts in their work; and their work was a visible symbol of the university's commitment to rational budgeting.

The only analyst who has never seen decisionmakers choose an alternative unsupported by the numbers is the novice. As one Vice President in a public university remarked, "I know how to find a rational solution; what I need help with is gaining political acceptance for a rational solution." The role of information in generating a rational solution is critical. No one understands this better than the information professional. What is less often considered is information's contribution to the rational decision process. Such a process insures that those who make policy decisions are relatively free of nonrational constraints.

The process used by Stanford University to allocate the operating budget during the 1970s was unusual in that the rationality of organizational procedures has been documented (Chaffee 1981). That process depended heavily on information. However, before examining the role of information in decisionmaking at Stanford, it may offer a valuable perspective to examine the role of information in other kinds of decisionmaking processes.

Theory provides four major models of decisionmaking at the organizational level of analysis—the rational, bureaucratic, political, and collegial models (literature on these models is listed in the appendix). Although a full elaboration of the models and the ways in which participants use information in each model is beyond the scope of this paper, a summary of the role of information in each model is offered in table 1. As the last two rows of the table indicate, rational decisionmakers use information to identify the alternatives with maximum cost-benefit ratios. This is a critical function in making rational choices. In the collegial model, analytic information is important, but one can readily imagine a situation in which it is outweighed

INFORMATION CONSIDERATIONS	DECISIONMAKING MODELS			
	FORMAL RATIONAL	COLLEGIAL	BUREAUCRATIC	POLITICAL
What is information?	Verifiable facts, probabilistic analyses, expert judgment	Verifiable facts, probabilistic analyses, expert judgment, rhetoric	Verifiable facts, digested and presented according to routines	Verifiable facts, probabilistic analyses, persuasive rhetoric
What is it based on?	Problem definition	Problem definition	Procedure, precedent	Partisan debate
Who prepares it?	Professional analysts, substantive experts	Everyone	Administrators, especially at lower levels	Anyone with a position to advocate or refute
Who uses information?	Line authorities	Everyone, collegium	Specific administrators	Partisans
When is it used?	Early in the stages of problem-solving; continuously only by choice	Early in the stages of problem-solving; continuously only by choice	Regularly, as determined by standard operating procedures	Early in the process of issue attention; continuously only by choice
Why is it used?	To discover the relative costs and benefits of choice alternatives	To check relative validity of choice alternatives as means to agreed-on objectives	To address issues as historically and continually established by the organization	To reveal mutual benefits of alternatives and relative power
What is the goal of information use?	To identify the alternatives with maximum cost-benefit ratio	To iterate toward consensus	To identify the current state of traditional decision premises	To persuade contenders toward a self-interested favorable outcome
How important is information?	Critical--no decision possible without it	Very important, but so is a colleague's opinion	May be important (a) for diredt use in making a decision and/or (b) for organizational continuity, stability	Very important (but indirect) effect on decision in that it helps determine and justify actors' positions

Table 1

ROLE OF INFORMATION IN DECISIONMAKING

by a contrary opinion, based on values, from a respected colleague. Analyses and discussions may proceed through many iterations until participants reach consensus. Information is a stable function of history in the bureaucratic model, tending to deal with decision issues that arise regularly. In the purest case of bureaucracy, periodic information reports use historically determined algorithms, simply inserting new data for the current time. This may produce stability and continuity in some cases, stagnation in others. (For an interesting study of the latter case, see the discussion of Ford Motor Company's analyses in the early 1970s, Zammuto, forthcoming.) In political decisionmaking, information is used by partisans to make a case for their position and to persuade others toward that position. Since positions are determined by self-interest, information is not unbiased, nor is it used to identify the best solution. Rather, information provides a cloak of respectability for the position. People have a prevailing preference for rational decisions, and information symbolizes rationality (discussed in Feldman and March 1981, Pfeffer 1981).

For whatever reasons, people do prefer rational decisions; one need look no further than the curriculum of any business school for proof. Can information specialists contribute not just information but also some of the procedural aspects of a rational process? The Stanford experience suggests some ways in which they can. Stanford enjoyed a sizable advantage in this regard, as a private institution that was not directly accountable to taxpayers and government representatives. Nonetheless, the special contributions of the information structure to rationality are generalizable and may be useful in public universities as well.

In some ways, the contribution of Stanford's information specialists to rationality was obvious. Analysts helped administrators gain greater control over uncertainty than they would have had otherwise. Analysts also combined complex data so that costs and benefits of alternative courses of action became comprehensible. Information is less well-known for five other ways in which it promoted rationality at Stanford:

1. Information was structured to provide a chronological skeleton for the process of deciding the operating budget.

2. Information processing was used to bring diverse people together so that the budget subsequently reflected a university-wide perspective.

3. Information was used to identify what was not known.

4. Information yielded goals and motivational concepts.

5. The strong information component of the budget-setting process served as a symbol of the university's commitment to rational decisionmaking.

Chronology. Rationality begins with establishing values. Accordingly, Stanford's annual budgeting began with two major information processes that helped establish values. One was the Long Range Financial Forecast (LRFF), based on the current budget and extrapolating by a computer model to a five-year projection. By making several runs using different assumptions, the participants learned how different rates of inflation, of revenue-production by type, and of expenditure by function would change both short-term and long-term financial conditions. The LRFF thus enabled decisionmakers to determine such financial values as how much relative emphasis to place on types of expenditure or revenue, and Stanford's relative need for financial restraint.

The second value-setting information activity was the protocol process. It began with a letter from Provost to Deans identifying the major trends and goals for the year, then meetings of Provost with Dean to discuss priorities, and finally letters from Deans to Provost listing budget requests and analytic documentation for each. Information specialists, staff to both Provost and Deans, provided raw materials for this process--a process that also identified the alternative choices for expenditure. Alternatives for revenue and for overall constraints on the budget arose largely through concurrent development of Parameters Papers, one-year analogs to the LRFF that were reiterated with successive refinements as more information became available.

Each of these information tools, and others to be described below, was used annually from 1972 through 1980, leading not only to the final budget but also to a booklet called Operating Budget Guidelines that summarized their results. The booklet was both widely distributed and available to anyone who asked for it. It was, in essence, the final information tool in the process, serving as an orientation point for much of the preceding activity.

Diverse perspectives. In complex situations, the rational process depends upon contributions from diverse sources in order to identify all alternatives, all costs, and all benefits. At Stanford, this suggested a need for communication between the academic and business staffs, between faculty and administration, and between information specialists and decisionmakers.

Development and successive refinements of the LRFF and Parameters Papers formed the core of the agenda for weekly meetings of the Budget Staff from August through March. Participants were information specialists from both the academic and business components of the university. Early in the 1970s, they developed TRADES (later to evolve into EDUCOM'S Financial Planning Model), an interactive computer model of revenues and expenditures. TRADES was developed as a tool for decisionmakers. Most of the senior line officers tried it. For some of them, it was their first computer experience. The staff learned of the interests and limitations of the line officers; the line officers learned the power of information, from a new perspective. In addition to this shared experience with TRADES, which lasted only a short time, the members of Budget Staff met biweekly with the line officers in Budget Group to exchange information and concerns. Line officers reacted to versions of the LRFF and Parameters Papers, suggested new assumptions based on their values or information, and oriented Budget Staff members to other factors that would affect the budget for the coming year.

A common means of bringing administration and faculty together over budget issues is for a key administrator to make a presentation at the Faculty Senate. This was done at Stanford. In addition, however, Budget Group annually invited leading members of the faculty, primarily from economics, to lunch. The major purpose was to glean the economists' opinions about likely economic trands that would affect the budget. But a by-product of the session may have been a certain amount of faculty satisfaction at having been consulted in formulating the university's budgetary assumptions.

Information gaps. Rational decisionmaking is nothing if not comprehensive. Unless all alternatives are known, all costs and benefits analyzed, the solution cannot be assured of optimality—at least in theory. Therefore, any means for identifying and analyzing new alternatives, costs, and benefits promotes rationality. At Stanford, the information system had a tendency to reveal not only what was known, but also what needed to be discovered.

For example, the financial models made compelling the need to exert control over the budget and the major driving force behind expenditures—faculty positions and salaries. Soon after the models were first used, the Provost initiated a control system that ensured his awareness of vacant positions, and his opportunity to influence the filling of these vacant positions.

The staff also developed a paper-and-pencil matrix listing every request for the upcoming budget with columns for each type of funds that might be used to finance them--including "unfunded." Reviewing this list every year made budget decisions simultaneous, rather than sequential. This review ensured that attention was paid to explicit tradeoffs among alternatives. This review also helped to identify where more information was needed before deciding.

Each year, issues arose that were poorly understood. They often came up when the staff was refining assumptions for financial modeling. These issues were flagged for analysis in special studies undertaken during the slower summer months. One such issue recently was the effects of financial decisions in one unit on the financial requirements of another. The interdependencies were often so complex that a new information process, called economic impact analysis, was required of any unit proposing these kinds of decisions.

Goals and motivation. Rational decisions are useful only if they are implemented. Stanford's information specialists were creative in giving labels to various concepts and problems in budgeting--labels that were picked up by decisionmakers and used both to define goals and motivate others to help achieve them. Two of the most powerful terms in university-wide use were gap and equilibrium. Gap has uncomfortable connotations. When used to describe the growing distance between income and expense, a phenomenon that early runs of the LRFF pointed out, the term became symbolic of the need for unified action to close the gap. Subsequent analyses showed that the basic problem was not just differences in total income and expense; the problem was differences in the rates of increase of the two. Modelers suggested that these rates of increase should be brought into equilibrium--a term that motivated an entirely new round of belt-tightening.

Less widely used in the university, but important to members of Budget Staff and Budget Group, were the terms _f_ and _a_. The term _f_ was shorthand for funded improvement, a small margin of discretionary funds available for special projects and new ventures that was deemed necessary for institutional vitality. The term and the funds it represented were important symbols that the university did not intend to allow stagnation, despite the need for austerity. Over time, the list of funded improvements became increasingly difficult to manage. Budget Staff members determined the primary cause of this difficulty. They designated it _a_--new expenditure requests carrying such compelling mandates that they could hardly be called discretionary. This analysis motivated further efforts to understand and deal with the problem.

Symbol of rationality. Feldman and March (1981) state an eloquent case for the intrinsic value of information in a rationalistic culture because information use symbolizes a commitment to rational choice, and it signals personal and organizational competence. These investigators also assert that organizations systematically request and analyze far more information than they use--regardless of the decision model--in order to legitimate their decisions. It is not remarkable that information use served this function for the Stanford budget process.

Stanford participants may have been more overt than is often the case in using information as a symbol of rationality. They could, however, afford to be more overt. As empirical research later verified, and as faculty and staff members apparently noticed, values were just words until a budget--congruent with values--allocated resources in support of those values. Values became reality when budget decisions during the 1970s actualized the four basic value premises that were held by the Provost throughout the decade: excellence, student interest, funding potential, and academic importance. As a result, when the Provost took a set of tables to the faculty senate, or the budget office issued the Operating Budget Guidelines, those in the audience were inclined to have faith in the information as a true representation of the rational process it symbolized and supported. Evidence of that faith arose in a seminar when the Stanford budget process was characterized as political, not rational. A senior faculty member in political science was so agitated by this suggestion that, unlike others in the seminar, he rose to deliver his rebuttal. According to that stereotypical archenemy of administration, it was rational.

If information specialists wish to foster a rational process, the Stanford experience provides them with some suggestions. Information specialists can seek to provide a chronological skeleton to the problem-solving process. This helps to define values before analyzing alternatives. Further, it ensures that the preparation of information anticipates, rather than follows, the information needs of decisionmakers. Information specialists can also use the occasion of preparing analytic reports to bring diverse people into communication with one another. Information is more useful for a rational process if it exhibits two additional features. The processing of information should call attention to that which is not known. The development of information should yield conceptual tools that decisionmakers and others who must cooperate can use to motivate actions congruent with the decision. Finally, it may be that explicit attention to the symbolic value of information can create a self-fulfilling prophecy--the organization that seems to base its decisions on rational information eventually will base its decisions on that information.

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Decision Support Systems: Finding the Best Mix Of Information, Technology, and People

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A decision support system has four basic components; data files, models, problem solvers, and interface facilities. The supposition of this paper is that the problem solvers′ (managers′) capabilities can be amplified and supplemented, but never replaced. Thus the data files, models, and interface facilities must be geared to the manager if the decision support system is to function properly.

Since problem solvers function at different levels of the hierarchy, the system must respond to a wide variety of needs. Many of the needs, perhaps most, are undefinable before the particular problem about which a decision must be made arises.

This paper sets forth how Pepperdine University is attempting to meet its needs for a decision support system by providing: end user access to data through terminals; the availability of retrieval modules and languages which allow the manager to structure his/her own ad hoc reports and/or summary files; access to models locally and through a national network: and, training, encouragement, and consultation through Information Systems Coordinators for the decision makers.

INTRODUCTION

For all practical purposes, widespread administrative computing in higher education began with the decade of the 1960's. More often than not, the data processing (DP) function was administratively under the Controller or Vice President of Finance and the word of the hour was "control."

The decade of the 1970's brought bigger, faster machines and an organizational maturing process. The DP functions evolved into Management Information Systems (MIS) and DP managers became Directors of Computer Services. The MIS organization reported to the Vice President of Administration, the Executive Vice President, or even the President.

As we now progress into the 1980's, new vice presidential areas, such as "Systems and Planning" or "Information Resources and Systems," are beginning to appear with some frequency. Computer Services is only one of several information systems areas reporting to such individuals. A MIS is no longer the ultimate in providing administrators with "exactly enough of the most relevant information at precisely the right moment to produce an infallible management decision—at the least possible cost."[1] Decision Support Systems (DSS) are now in vogue.

A DSS has four basic components: Data Files, Models, Problem Solvers, and Interface Facilities (See Figure 1).[2] The following features are characteristic of a DSS: (1) It supports problem solvers at many levels of the organization in dealing with the non-repetitive, ill-structured challenges of administration; (2) It is developed by an endless, adaptive learning process involving the problem solvers themselves; (3) It is used more or less directly and interactively by the problem solvers (perhaps through close subordinates); (4) It meshes with the thought processes of the problem solvers in such a way as to extend and enhance the administrator's own understanding and judgment, rather than providing "the" answers to specified questions; (5) It does not purport to place great volumes of data at a problem solver's finger tips (DSS complement MIS rather than supplanting them); and (6) No DSS will be the perfect answer to a problem solver's fondest dreams of computer support.[3]

Despite the promise of DSS, some have already said that it is a failure about to happen. They say that history is being repeated; that DSS will go the way of the MIS--for all practical purposes, an expensive failure.[4]

The authors of this paper disagree with this general contention while acknowledging the difficulty in fitting appropriate data files, models and interface facilities with the problem solver.

UNDERLYING ISSUES

There are, we believe, in addition to the inherent value of DSS, several underlying issues that taken together provide an adequate impetus to overcome the problems of developing a DSS mechanism.

The first such issue has to do with the problems associated with MIS. A definition of what a MIS is supposed to be, what it is, or a consensus opinion of if it is worthwhile would be difficult to obtain from any given set of users. The all too real expectations that an MIS provides "exactly enough of the most relevant information at precisely the right moment" illustrate well the oversell associated with MIS. Finally, the contrast between what management theory says managers do, i.e., planning, organizing, staffing, directing, and controlling (the functions MIS were designed to support), and what research studies show managers really do, i.e., provide formal authority and status or fill interpersonal, informational, and decisional roles, is striking. It points to at least an hypothesis that the basic design of MIS may have been faulty.[5]

The second issue involves the concept of Information Resource Management (IRM). IRM means that the organization treats information as a resource—a resource not identical to people, machines, markets, and money--but similar enough that management principles can be applied without difficulty.[6] We live in the Information Age: more and more of the workforce consists of people who work with information; we are besieged by new information sources; better information provides us with the competitive edge; and the dominant industry of the future is destined to be the information industry.[7] IRM is a response to the increased complexity of operating in the environment of an Information Society. This environmental stimulus demands a faster, more accurate, more targeted response than ever before. This is what IRM is all about: getting the right kind of information to the right people in the right form at the right time at a reasonable cost.[8]

A third issue is the continuing evolution of Computer Services organizations toward computer utilities. This process will be increasingly driven by several factors: Lower and lower hardware costs versus higher and higher costs for technical personnel; greater client demand for more diversified services versus an inadequate delivery capability; networks which connect micros and minis to local and national hosts , providing interfaces between data bases and models never before available; and more user friendly, powerful software.

Technological/computer literacy is the fourth underlying issue. The average computer user is becoming more and more sophisticated and the number of computer users is rapidly expanding. The advent of the personal computer is speeding both of these trends and will do so even more in the very near future. As the number and sophistication of the user community grow, so does the demand for more user specific knowledge. This demand is being met through seminars, institutes, continuing education, and special academic course offerings.

The last issue to be discussed involves the fact that different information is required for decisions at different levels of the organization and much of it, particularly at the top, is undefinable "up front." (It should be noted that this list of issues is illustrative and not meant to be exhaustive.) Recent management theory tells us that in most organizations there are usually three to six critical success factors (CSF) that ensure success in the organization if they are satisfactorily addressed. This concept may be applied strategically to the operation as a whole (the CEO) or to individual managers within the institution. In both cases, to appropriately address CSF, current information needs—both hard and soft—must be met.[9]

The general rationale just given leads us to believe that as energy-driven machines augmented muscle power in the industrial revolution, so will information-driven DSS increasingly augment brain power in the ongoing information revolution.[10]

The Pepperdine University Approach To DSS

This section describes the approach taken by Pepperdine University to meet the challenge of developing and installing (or should that read "installing and developing?") DSS for its administrative client community.

Computer Services is organized in a manner that permits continual user input to the system development process. This is true especially with regard to our committee structure. (See Figure 2) The Systems and Planning Committee is made up of the operational Vice Presidents, the University Controller, and the Executive Assistant to the President. This committee is responsible for reviewing and recommending approval of Computer Services' budget, for prioritizing all major system development, and for authorization of expenditures for funds for all system development, including all computer related hardware, software, and supplies. The Director of Computer Services makes a monthly status report to this group concerning Computer Services' performance against standards. Since all computer related expenditures are centralized and must be approved by this committee, the Director and his staff often assist client community members in the preparation and presentation of requests for hardware or software. The Director presents a zero-based budget (ZBB) set of alternatives to the committee. Budgeting is directly related to service, and the University, through its vice presidents, recommends to the Budget Committee approval for a level of service that has attached to it a dollar cost.

The Data Administration Group (DAG) meets weekly to discuss progress on system development and system enhancements and to discuss implications of any changes in University policy or procedures as they impact systems. Regularly attending this meeting are middle level managers in all client offices served by Computer Services. DAG is responsible for prioritizing all client requests for enhancements or corrections to the systems, as well as requests for minor system or subsystem development.

The Interoffice Communications Committee (IC) brings together on a weekly basis various members of the client community who are involved with systems in their office. IC deals with procedural matters related to systems and forwards to DAG recommendations related to system operation or modification. Input and support from this group are key to acceptance and successful operation of systems. This is true since these persons have day-to-day interface with all systems and are primarily responsible for maintenance and, thus, the integrity of the basic data files.

The preceding discussion of committee structure does not define a DSS. Rather, it describes a framework wherein that concept can be developed, a framework we believe to be essential.

The DSS development is described in the Computer Services Strategic Five Year Plan. This document was written after extensive interviews with the client community. The Systems and Planning Committee and DAG approved the official plan before it was released. We intend to use this document as a constant "working draft," for the purpose of showing long term University direction while being subjected to revision on a yearly basis, thus allowing for adherence to current institutional needs.

The Plan is discussed in two phases; the first describes what will be completed in the next 18 months to two years. The second phase, less detailed but more ponderable and perhaps exciting, lists tasks that are scheduled for implementation in 1984 and after.

DSS Building Blocks

As indicated earlier, a DSS consists of data files, models, problem solvers, and interface facilities. These components must be integrated within a unified framework and organized to support the various decision-making processes within a prescribed domain over an extended timeframe. The following definitions are needed for discussion: (1) A data file is a list of related facts or data in computer-readable format (this should be distinguished from the basic data files of a MIS); (2) A model is a careful description of a real system (it may be mathematical or, for easy managerial understanding, it may be set forth in narrative, diagrams, lists, etc.); (3) A solver, or language system, is a computer program for executing a model (as opposed to the problem solver or manager); and (4) an interface facility or problem processing system (PPS) is a means of communicating with the data files, the model and the solver.[11]

Pepperdine University's basic institutional data are maintained in generally integrated files. At this time the remaining tape driven batch systems are being converted to disc, and routines are being developed that will allow ready accessability to all of the basic data of the central files. DSS data files may then be derived from the institution's MIS through several avenues, or they may be separately created and maintained.

Each of the major files, e.g., Student Records, Financial Acounting, and Development have their own ad hoc retrieval modules capable of producing reports or summary data files for use in DSS. The commercially available Mark IV and Mark IV Auditor are also accessible to extract and manipulate basic data into DSS data files. Additionally, a university developed on-line retrieval system, called POWERS, permits users to select data and create output files based on certain selection criteria that include Boolean functions. POWERS may also be used in conjunction with the mainframe's word processing system to produce individual specific written output. By early 1982, POWERS will be available for use with all on-line systems. A POWERS users group has recently been formed to help in training new users and in the development of new ways to use the system more effectively.

The Institution's MIS creates and maintains a DSS data file for Institutional Research (IR) on registration data and for Payroll/Personnel on their own data file. The IR department also maintains DSS data files for the Institution's budget and for financial ratio analysis.

These applications are admittedly crude but, perhaps surprisingly, are reasonably effective. By the end of this academic year most administrative users of the central data files will have these capabilities and with them, the first step toward a DSS.

Model usage within the Institution is available through various means. At this point IR is the most versatile client utilizing EFPM, VisiCalc, SPSS, and Mark IV. The Five Year Plan calls for most users to have access to some modeling capability by the end of phase one.

Computer Services is sponsoring an on-campus EFPM workshop conducted by EDUCOM in mid January, 1982 aimed at approximately twenty interested individuals from various administrative areas. The purpose is to prepare the user community for increased modeling activities as a vital element in the development of DSS. An administrative micro computer users group is also being formed, for the same purpose, to better acquaint those who have access to VisiCalc, VisiPlot, VisiTrend, and DB Master to the rather significant capabilities of this micro software.

Certain EFPM models will be developed by IR and "given" to the end user, at least initially. In this process IR will also develop a crude solver for the user. At least one piece of micro software is currently being evaluated as a solver for VisiCalc. Again, these illustrations are extremely crude but show ways to move toward a DSS environment in the near future.

The interface facility of DSS is the component in phase one most difficult to implement. To do so requires a network linking the mainframe, administrative micros, terminals, and EDUNET. It also involves the development of software to allow interfaces between basic data, retrieval modules, Mark IV, SPSS, micro files and EFPM.

Network

While network details have not yet been defined, certain parameters do exist. Most likely the network will use broad band, rather than base band, PBX, fiber optic, or other technology. The reason for this selection is pragmatic. The University has a broad band TV cable connecting most buildings on campus. Also, broad band technology appears to be cost effective and flexible. It is anticipated that initial aspects of the network, i.e., at least one short link, will be completed by July, 1982. The fully developed network should be implemented during 1983. Increased capabilities in each of the other DSS components will also continue to be developed.

1984 And DSS!

By 1984 it is anticipated that the University will have a significant network, allowing all major administrative users access to the MIS data files, retrieval packages, their own DSS data files, models and some sort of minimal solver (still requiring significant user involvement for effective usage).

Phase two of the five year plan calls for installation in 1984 of a Univac 1160 mainframe. This device will have significantly more memory and mass storage and most importantly, will allow installation of an all purpose software package aimed at the completion of a true DSS. Such a system may well incorporate a solver or language system with a PPS (interface facility) and a knowledge system (DSS data files).[12]

If our plan is implemented on schedule, the mid 1980's will see functional components of a DSS at Pepperdine University. The DSS components will be available to the senior administration (the President and Vice Presidents), the academic administration (the Deans) and to the mid managers (IR, Financial Aid, Registrar, etc.) The success of this endeavor will not, however, depend upon the integrated circuits of an 1160 or the silicon chips of an Apple II plus, for they cannot replace the instincts, reasoning and decision-making capabilities of the mentioned administrators. It will depend greatly upon the training and beliefs of these problem solvers.

In an attempt to ensure that the problem solvers will be aware, supportive, and capable of effectively using the DSS, the Information Systems Coordinator positions in Computer Services will become Decision Support Coordinators (DSC). Historically, these positions have served as the primary liaisons between Computer Services and the client community.[13] They have been deeply involved in the design, training, and daily operation of current systems and will likewise be involved in the DSS. They are known and trusted by the client community. The DSC role will be that of a consultant working with a client to bring about more effective decision-making by the client.

Summary/Conclusion

DSS will be to the 1980's what MIS was to the 1970's. For most of us, significant technological advances must and will be made with hardware and software to supply the necessary components of a DSS. The real key to successful DSS lies not in this 1984 technology, but in the problem solvers themselves. We therefore believe that building a DSS in an environment with significant user oversight, user participation in planning, mutual training and a concerted effort not to oversell the expected results will lead to the optimum system. We are optimistic but we recognize the reality in the words of Machiavelli taken from The Prince:

> It must be remembered that there is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new system. For the initiator has the enmity of all who would profit by the preservation of the old institution and merely lukewarm defenders in those who would gain by the new ones.

As true and as sobering as this may be, we choose to close this paper with another quotation by the futurist Alvin Toffler, taken from his book, The Third Wave:

> ...We are destined to transform our own minds—the way we think about our problems, the way we synthesize information, the way we anticipate the consequences of our own actions. ...There is nothing magical about (Computers)...yet...they remain among the most amazing and unsettling of human achievements, for they enhance our mind-power as (the Industrial Revolution) enhanced our muscle-power... . We will begin to use computers with a grace and naturalness that is hard for us to imagine today. And they will help all of us...to think more deeply about ourselves and the world.

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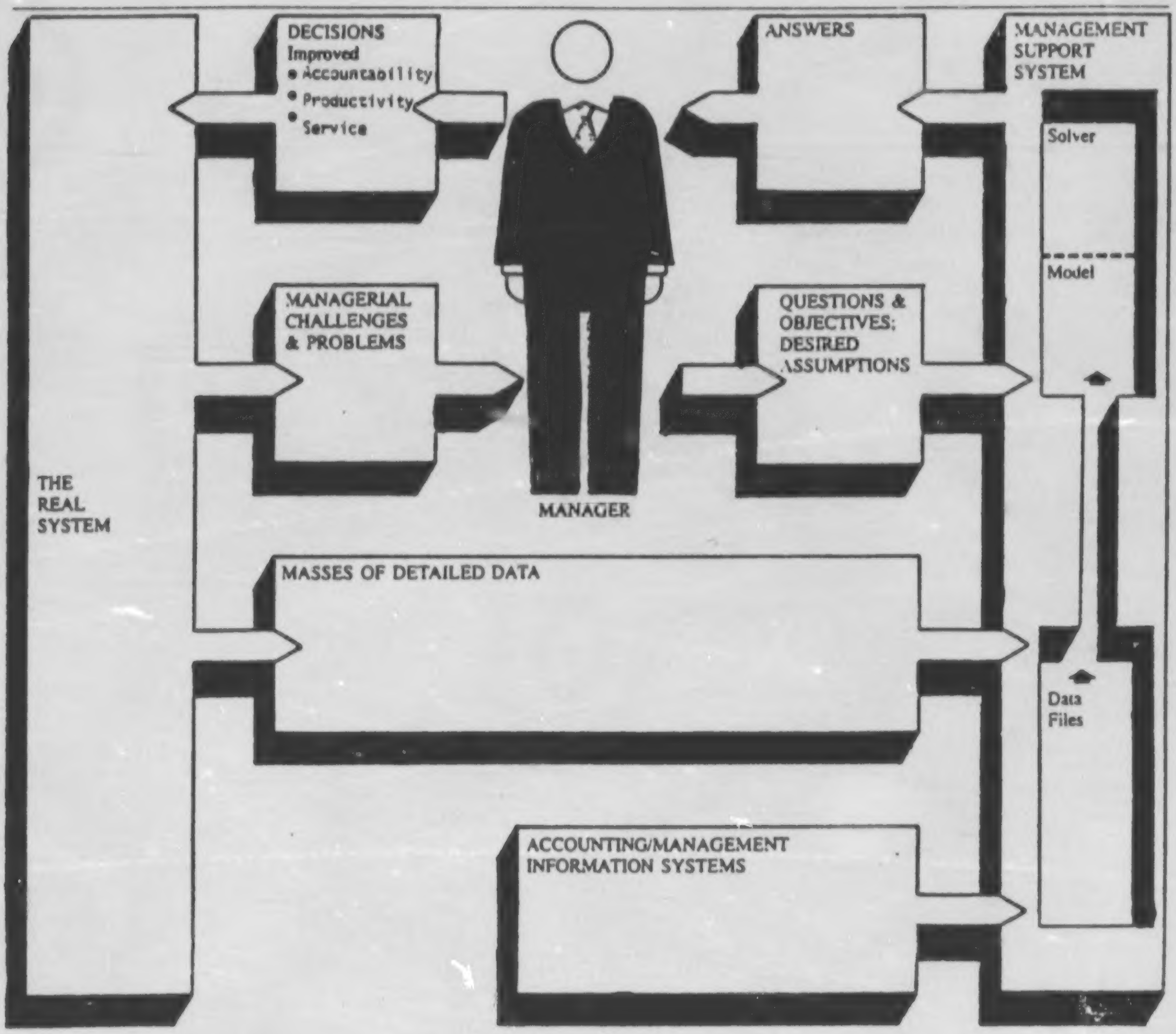
FIGURE 1

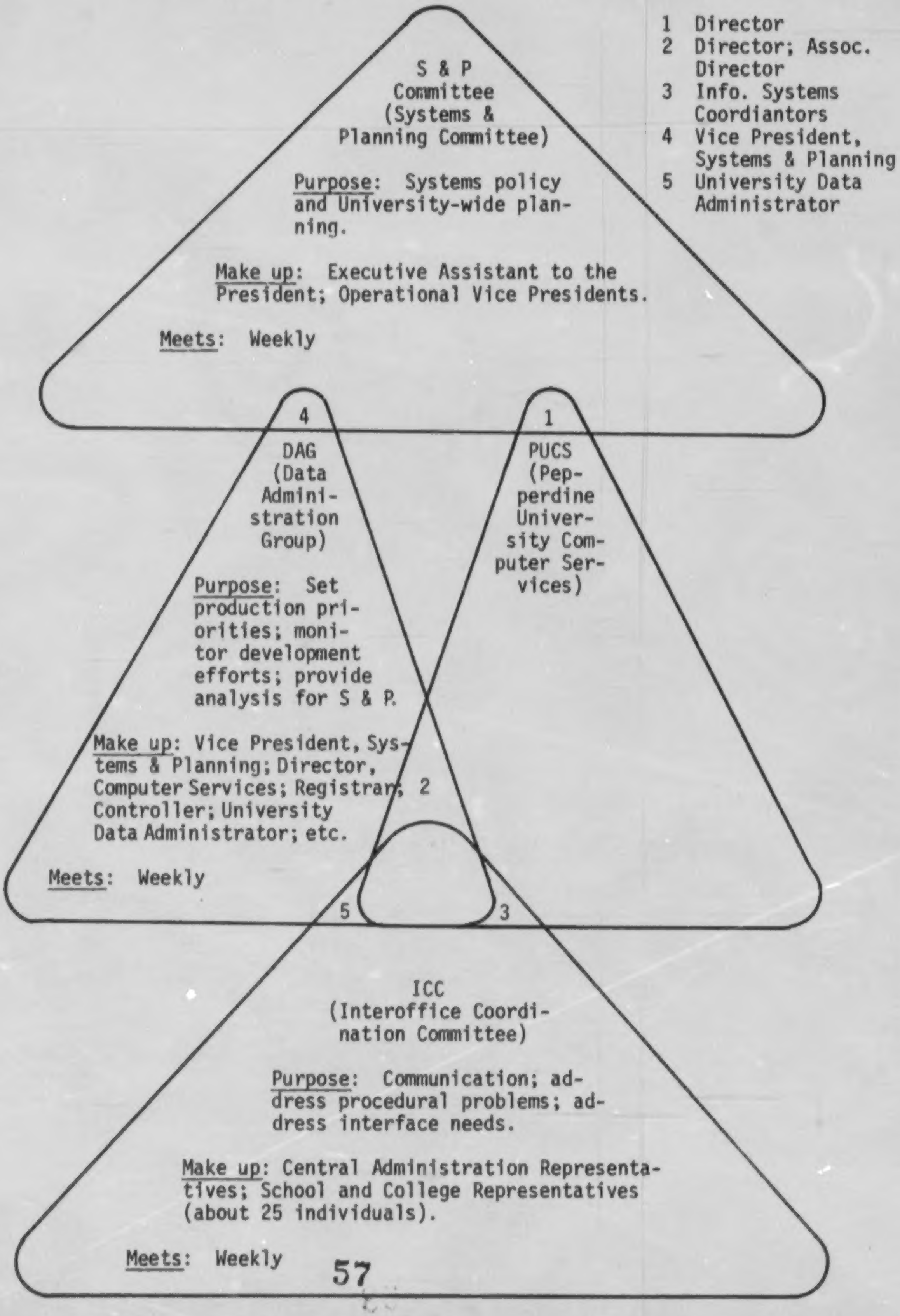
HOW THE SYSTEM WORKS


DECISIONS
Improved
• Accountability
• Productivity
• Service
ANSWERS
MANAGEMENT SUPPORT SYSTEM
Solver
Model
MANAGERIAL CHALLENGES & PROBLEMS
QUESTIONS & OBJECTIVES; DESIRED ASSUMPTIONS
THE REAL SYSTEM
MANAGER
MASSES OF DETAILED DATA
Data Files
ACCOUNTING/MANAGEMENT INFORMATION SYSTEMS

Source: Arthur M. Geoffrion and Richard F. Powers, "Management Support Systems", Wharton Magazine, Spring 1981, p. 33

Figure 2

Committee Structure for Computer Related Activities



1 Director
2 Director; Assoc. Director
3 Info. Systems Coordiantors
4 Vice President, Systems & Planning
5 University Data Administrator

S & P Committee (Systems & Planning Committee)

Purpose: Systems policy and University-wide planning.

Make up: Executive Assistant to the President; Operational Vice Presidents.

Meets: Weekly

DAG (Data Administration Group)

Purpose: Set production priorities; monitor development efforts; provide analysis for S & P.

Make up: Vice President, Systems & Planning; Director, Computer Services; Registrar; Controller; University Data Administrator; etc.

Meets: Weekly

PUCS (Pepperdine University Computer Services)

ICC (Interoffice Coordination Committee)

Purpose: Communication; address procedural problems; address interface needs.

Make up: Central Administration Representatives; School and College Representatives (about 25 individuals).

Meets: Weekly

Administrators Build Their Own Systems at Loyola

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ABSTRACT

Conventional data processing organizations are structured to develop high volume transaction oriented systems which provide day-to-day support of business operations. The prevailing application development tools and methods are not well suited for the creation of decision support systems, nor are they cost effective.

To meet a growing need for decision support systems, Loyola University of Chicago instituted a new program in 1980, Administrative User Services, which provides administrators with immediate, friendly access to computing at low cost. After some preliminary training and file initialization, users are responsible for their own data processing. User friendly software packages and the availability of the Administrative User Services Analyst make this approach successful even though most of our clients have never used computers before.

Planning of the hardware, software and human facilities is vital to success.

Background

To understand where we are today in data processing and where decision support systems fit into the spectrum of data processing services, we must take a brief look at the evolution of application development. When computer hardware first became commercially available on a wide scale in the late 1950's it was very expensive. Business computers could only be justified if the hardware would replace large numbers of clerical employees. Typically, transaction oriented applications for support of operating functions, such as payroll and inventory control, were the first to be installed. Data processing techniques, such as the system development life cycle, evolved which were well suited to these large scale repetitive applications. These techniques were effective in getting transaction oriented applications installed on-time, within budget and with reliable results.

The Management Information System

Data processing then turned to new horizons, the development of the Management Information System (Figure 1). The ultimate objective of the MIS was to convert the mountains of raw data collected by the operating support systems into useful information for management decision making. This was to be accomplished by the integration of the operation support and functional systems into one consolidated business management system into which the general manager could dip for information whenever a problem required analysis.

Although MIS was a popular data processing topic throughout the 1970's, the MIS has not become the common management tool envisioned in

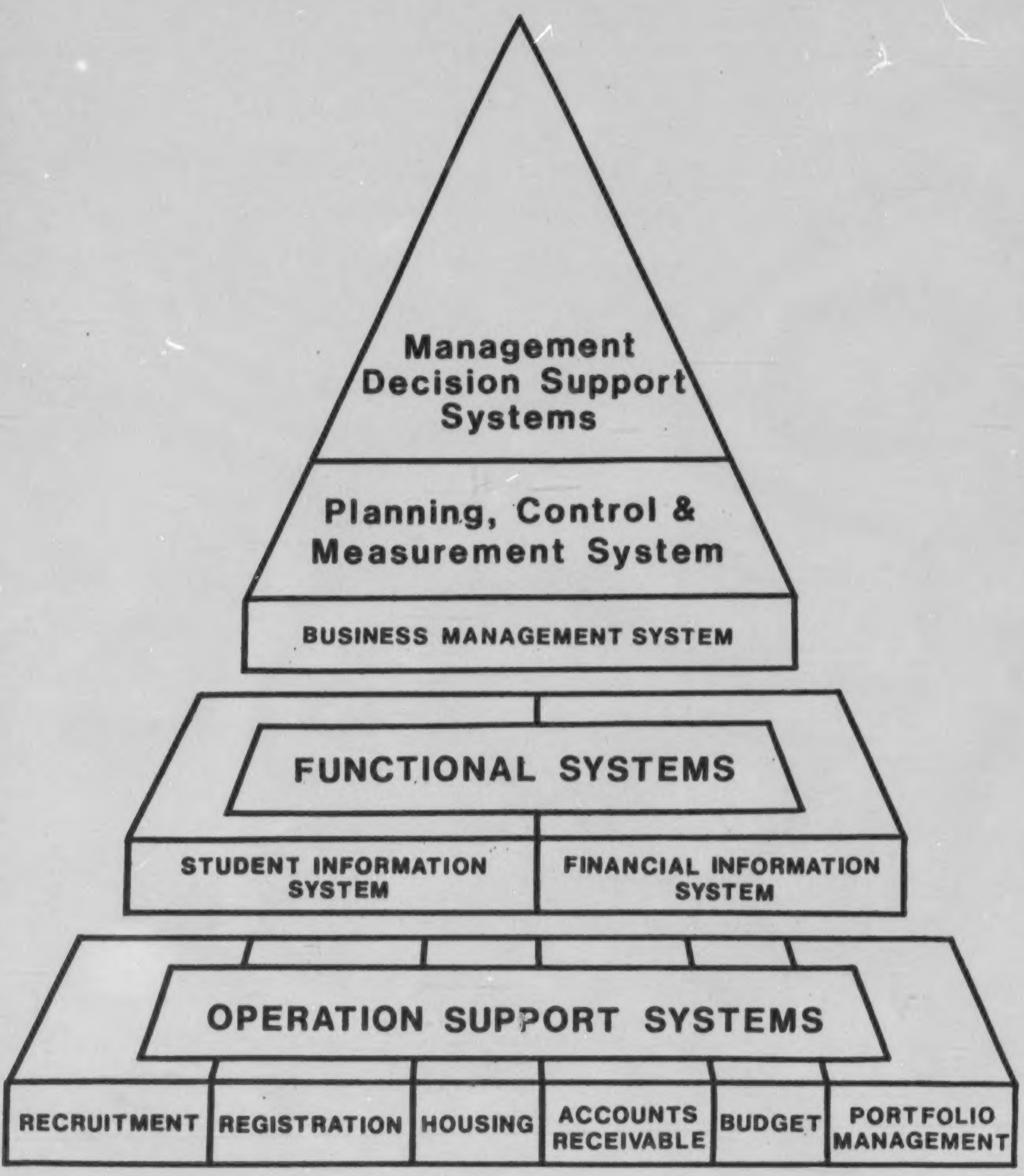
Management
Decision Support
Systems
Planning, Control &
Measurement System
BUSINESS MANAGEMENT SYSTEM
FUNCTIONAL SYSTEMS
STUDENT INFORMATION SYSTEM
FINANCIAL INFORMATION SYSTEM
OPERATION SUPPORT SYSTEMS
RECRUITMENT
REGISTRATION
HOUSING
ACCOUNTS RECEIVABLE
BUDGET
PORTFOLIO MANAGEMENT

Figure 1

the literature. What happened to the MIS?

The problem was not technological. Performance improvements in processors continue, storage technology has improved, and even software hurdles, such as the development of data base management systems have been met. The desire for "MIS" -- the ability of management to extract and analyze information from the corporate data base -- still exists as shown in a 1980 study by Alloway <1> which indicates that inquiry and analysis (decision support) system installations must increase by 726% to meet current user demand.

Operation Support vs. Decision Support Systems

The problem is that we have been attempting to implement the new inquiry and analysis applications for middle and upper management using the same tools we have developed for transaction oriented operation support systems. This was the path to information fulfillment prescribed by the early MIS experts who recommended that the needs of management be analyzed, documented, and implemented in the same way that payroll processing was defined for the computer. Yet the operation support system and the decision support system are fundamentally different.

The three major obstacles to developing decision support systems with conventional development methodologies are the differences in

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<1> Robert M. Alloway, *User Managers' System Needs*, (Cambridge, Massachusetts: Center for Information Systems Research, Working Paper Number 56, May 1980).

scale, timeliness, and structure.

Differences in scale make it difficult to cost-justify the development of decision support systems. Management typically needs to analyze a limited number of key data elements, many of which are derived from the external environment, not the corporate data base. The customary development approach involves the use of a team of analysts and programmers to translate the user's desires into an implemented system. For a complex operation support system where the cost of the development and maintenance will be spread over millions of transactions, this approach is cost effective. When files are small and/or the programs will only be executed a few times, the cost of the development intermediaries becomes prohibitive.

The second problem is that timeliness is critical to management decision making. The typical application development approach requires multiple steps of translation (eg. requirements statements, program specifications) before the user can review the results. This process simply is not responsive enough to deliver decision support systems within the short time-frame necessary for most management decisions. An operation support system which is not installed on time represents a depreciated opportunity; a decision support system which is not installed on time is a lost opportunity.

Finally, the techniques for developing traditional application development systems are geared towards converting well structured tasks to automated methods. The tasks of upper and middle management are by definition unstructured (or they would be clerical activities). As we move away from the operation support system, where there typically is a set of well-defined procedures, it becomes increasingly difficult to define the application. Yet institutions could clearly benefit if their managers had access to more effective tools for data analyis and retrieval; tools that could be provided by computers.

Administrative User Services

The solution, as we saw it, was to find a way to reduce the cost and time needed to implement decision support systems by providing administrators with immediate, friendly access to computing at low cost, thereby eliminating the development intermediaries (i.e. programmers and analysts). This service would be complementary to the operating support systems we continue to develop at Loyola.

To meet this need we instituted a new program, Administrative User Services in 1980. Planning for this new service focused on four areas: staffing level, location of facilities, hardware, and software. One of our planning goals was to minimize redundancy of data, software, hardware and personnel by using the resources already in place for student and faculty computing.

Staffing

Administrative offices at Loyola University are more or less evenly distributed among the three Chicago area campuses. We planned to take advantage of this distribution by, at least initially, assigning one AUS analyst to each campus.

The analyst's functions are determined by the type of application. For the typical small data management problem, they are:

1) Evaluate new service requests. Determine whether desired results can be achieved by conventional system analysis and programming of or by the use of AUS packages.
2) Identify the correct package for the application.
3) Design the database, if a new one is required, and establish input procedures.
4) Train the user in inquiry and report procdures.

We looked for staff who were comfortable using software packages and who would not attempt to implement COBOL solutions to user requests. Our first AUS analyst was a Psychology graduate student who excelled using the most popular user-oriented statistical packages (SPSS and SAS) and text processing tools (SCRIPT).

Location and hardware

Each campus already had an Academic Computing Center to support research and instruction computing needs. By locating the AUS service areas in the Computing Centers, we took advantage of the hardware and pool of terminals already in place. However, to protect the confidentiality of administrative data we had to isolate the AUS service center with room dividers.

We chose the downtown Water Tower campus to introduce the service because it had the best mix of good user contacts and potential applications.

We expected a greal deal of variability in the amount of terminal use by application. Further, several terminal types were already in use. IBM 3278's were in some administrative offices for transaction oriented applications under CICS. Academic clusters had 3278's and a variety of ACSII devices. To avoid a need for multiple screen editors, we decided that all AUS terminals would be able to run 3270-type full screen applications using SPF. Cheaper ASCII video terminals can be used as 3270's through the use of an IBM Series/1 front end running a 3270 emulation program or through one of serveral black box interfaces. Thus the terminal deployment plan:

1) Occasional users -- once a week or less: Use terminals in academic center or cluster.
2) Moderate users -- several times a week. Use cluster terminal or cheaper ASCII video terminal in office with dial access to the main system.
3) Heavy users -- several times a day for periods of several hours. Use IBM 3278 with direct connection in office.

Because of the relatively high cost of printers, the cluster and academic center printers (IBM 3203 at 600 lpm) provide all hard copy. AUS users also take advantage of Tektronix and CalComp graphics devices in the academic centers and an IBM 6670 laser printer at the Medical Center campus.

Microcomputers offer a very attractive alternative to mainframe access for office automation and management of small data bases However, because our first applications were expected to use existing mainframe-based files, AUS support has been provided on our IBM 3033-S mainframe. This approach also minimizes data redundancy.

Software

Our software strategy was to take advantage of existing resources as much as possible. The operating environment is MVS/TSO/JES2. The editor is IBM's System Productivity Facility (SPF), already in use by academic users and development staff. A TSO substitute, VAM (VTAM application manager) supports multiple SPF users in a single address space, reducing system cost by more than 50%.

User-oriented programs already used for statistics and text processing (SPSS, SAS, and Waterloo SCRIPT) are used by AUS, in some cases with tailoring to make them easier for particular applications.

These existing resources offer presentation-quality results for management reports. The Waterloo SCRIPT program supports the IBM 6670 laser printer with proportional text and multiple fonts. SAS has a graphics option that produces histograms, point and line plots, three-dimensional graphics, and more.

The existing collection of software lacked an important tool -- a data management system with a built-in report writer. FOCUS, a product of Information Builders, Inc., was chosen after an extensive search. FOCUS uses a non-procedural language that is very easy for novices to use, yet it allows both hierarchical and relational data sturctures for complex data storage needs. The product also has a report writer that can be used on existing files as well as its own databases.

A Typical Application

The Vice-President and Dean of Faculites wanted to automate storing twenty new items of information for each full time faculty member. These items include tenure status, special ranks such as chairperson or assistant dean, and deparment code of any multiple department appointments. Modifying our non-data base payroll master file to include these new data elements was impractical, although the payroll file does contain basic data that is needed for the desired reports.

FOCUS had a important capability that made this application easy: the new data can be placed onto a record in a FOCUS database, with a pointer to the existing payroll master file to non-destructively retrieve that information.

The analyst outlined his proposed solution to the service request and the manager of the application development team responsible for faculty records approved it. This was to insure that no existing data bases or reports already contained the desired information and to keep him aware of even the small needs of his clients. Then the AUS manager reviewed the proposed design, with emphasis on system performance issues and terminal deployment needs.

With the necessary approvals, the analyst then "set up" the defined the database to FOCUS and documented data entry procedures for the user. Then the user attended FOCUS inquiry and report writing classes. A meeting with the user then defined ongoing responsibilities and scheduled any production runs such as backups. The analyst or a student programming advisor is always available during normal working hours for any required user support.

Review of the Past Year

AUS is one year old at Loyola. We have had notable successes with projects like storing graduate school program records, keeping an inventory of faculty research interests and publications, and plotting proposed pay grade changes.

Our goal was to limit the setup time to three working days, getting the user involved as soon as possible. Two highly visible applications -- asset inventory and investment perfomance tracking -- have taken excessive setup times. The control and review procedures outlined above are designed to protect against that in the future. This will help insure that conventional development is used when it is appropriate, and the AUS analyst is free to work on decision support systems.

Summary

Decision support systems are fundamentally different from conventional operation support systems and require new implementation methods. The obstacles created by customary application development methodologies can be overcome by providing administrators with user-friendly tools and the technical support to develop their systems directly. Administrative User Services has proved to be an effective way to provide Loyola's management with inexpensive, timely decision support systems.

TWO USES OF THE EDUCOM FINANCIAL PLANNING MODEL SYSTEM TO BUILD NON-STANDARD MODELS

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In recent years, the EDUCOM modeling system (EFPM) has received considerable acclaim as one of the most versatile planning tools available. While the usefulness of EFPM in building fiscal forecasting models is well-documented, there are other uses of EFPM which have not yet been given equal publicity. If the 'standard' uses of EFPM involve the construction of fiscal forecasting models, then one might characterize models that are not fiscal models or not forecasting models, as being 'non-standard' uses of EFPM. This paper outlines a presentation which demonstrates that models, such as a faculty flow model and a historical trend model, can not only be built using EFPM but that the system facilitates their effective use by decision makers in higher education.

TWO NON-STANDARD USES OF THE EDUCOM FINANCIAL PLANNING MODEL SYSTEM

Introduction

The growth in acceptance of EDUCOM's Financial Planning Model (EFPM) in the three years since its formal debut has been nothing short of phenomenal. Today there are over 120 active subscribers to this modeling service within the higher education sector. If, in addition, we consider that at many institutions there are multiple users, each with their own accounts, passwords, and models, this list can be extended even further. In spite of these signs of forward progress, I have come to feel that the potential of EFPM to serve the needs of administrators in higher education is even greater than the image created by its successes and transmitted through the seminars conducted by EDUCOM. It is very likely that many people are initially turned away from EFPM upon first exposure because of mislabeling and the erroneous perceptions to which this leads. While it may be true that a misnamed rose is still a rose, a misnamed model stands a good chance of being an unused model. It is fortunate, and a testiment to its considerable power, that EFPM has prospered in spite of its often mistaken identity. In the first stage of development, the name 'financial planning model' was appropriate; it was fully descriptive of the prototype model as originally developed by EDUCOM. This was indeed a formal fiscal model, developed as a slightly generalized replica of a financial model used with considerable success at Stanford. However, field trials of this model demonstrated that it possessed the same flaw that characterizes so many fixed models, namely, the inability to easily adjust to the data and organizational peculiarities of different institutions. At this point, EDUCOM made a conceptual quantum leap by abandoning its attempt to develop yet another fixed model and focusing instead on building a system that would facilitate others in developing models that shared many of the characteristics of the Stanford model. Unfortunately, the name of the model was left behind in this leap. The two title words which should have been changed are 'financial' and 'model'.

The EDUCOM product is not a model--at least not in the usual definitional sense. In fact, its power is primarily due to the loosening of the restrictions that are associated with a model. Administrators who have suffered through a trying experience with some other highly touted formal planning model—and there are quite a few of them—quickly become preoccupied when someone begins to describe EFPM in terms of a ´model´. The second word,´financial´, is correct but limiting. It creates the impression that one can only use the EDUCOM product to model financial situations--an implication which is decidedly false.

The purpose of this presentation is to demonstrate to a critically important audience the flexibility of EFPM. The next section is intended for those people who have had no previous experience with EDUCOM; current users of EFPM and those who have attended one of the EDUCOM seminars, such as the one preceding this convention, may wish to skip ahead to the sections dealing wit nonfiscal modeling—the primary focus of the presentation.

The EFPM System

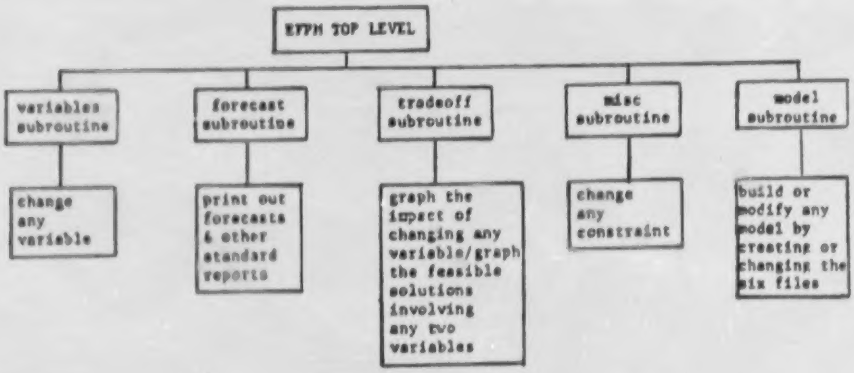
EFPM is an interactive computer system which enables the user to quickly and easily build a certain type of model using a high level language. In addition, the system provides a variety of special subroutines (called ´options´) which allow the user to quickly build the model, change input values, define printouts, graph outputs, and ´solve´ problems by finding those input values that lead to certain desired outputs in any future time period. The entire process of building and using a model is conducted by means of a question/answer dialog with a computer while seated at an interactive terminal with a printer or CRT scope. One unusual feature is that the modeler does not use his own institutions computer; the EFPM programs are contained in the computer at Cornell University which is accessed by special communication lines (Telenet, TYMNET) located in 250 cities, that are in turn reached by ordinary phone lines. Thus the user has cheap, convenient access to the model without any of the usual headaches associated with maintaining and revising a program. EDUCOM's EFPM staff members answer technical questions and even visit institutions as paid consultants.

EDUCOM conducts frequent one-day seminars, usually in conjunction with national meetings of higher education organizations, for purposes of showing how the EFPM system operates. I will present here only enough material to demonstrate how EFPM is commonly used in order to provide the backdrop for the next section—non-standard uses of EFPM.

The Standard Use of EFPM

EFPM was originally designed to facilitate the solution of financial problems; it is no surprise then that nearly all the models currently being used via EFPM are fiscal models. This usage could thus be termed the 'standard' employment of EFPM. Both in building a model and in the later running of it, one uses several EFPM subroutines which are all connected together in what is called the EFPM 'tree'.

figure 1. The EFPM Tree


EFPM TOP LEVEL
variables subroutine
forecast subroutine
tradeoff subroutine
misc subroutine
model subroutine
change any variable
print out forecasts & other standard reports
graph the impact of changing any variable/graph the feasible solutions involving any two variables
change any constraint
build or modify any model by creating or changing the six files

For our purposes, it is sufficient to briefly indicate the primary function of each subroutine:

> Model — This is the routine used to construct or later modify a model.

Variables — The routine that enables the user to change the value of any variable and thereby simulate different situations.

Forecast — This routine produces the output specified by the user. Such output can take the form of either a tabular, year-by-year forecast or a graph of selected variables plotted against time.

Tradeoff — This routine, the most unique feature of the system, was the primary contribution made by the Stanford Model. Once the user decides what future outcome is desired by specifying the values of certain variables, (e.g. ´surplus´ = $1,000,000), this routine enables the modeler to find the particular combination(s) of controllable input values that will result in the desired outcome.

The model building phase consists of providing information needed for six data files. All equations are entered in a very simple notation and the modeler is spared the necessity of spacing the data according to some format--only the order is prescribed. A complete model consists of the following files:

Initial — A file containing every variable which is used in the model, the long name of the data element as is is to appear on any printout, its initial value, and a reference number.

Budget — A file containing equations called ´budget equations´ that link variables within a given time period.

Growth — A file containing ´growth equations´. These equations provide the linkage between time period t and period t+1 by specifying the manner in which variables ´grow´ (increase or decrease).

Report — This file is used to label the reports and list the variables that are to appear on the forecast printouts.

Constraints — This file sets lower and upper bounds on variables. It is used to ensure that ´solutions´ are within reasonable limits.

Steps — Most variables in the model take on values that are calculated from either other variables or from growth rates. In some cases, however, the user may wish to have the model ignore the calculated value for a particular year and use instead a specified value (e.g., the state appropriation for FY 1983-84). These special, incremented values are entered by means of the ´steps´ file.

To someone approaching the EFPM system for the first time, all the above probably seems complex and little different from other educational models. Figure 2 is provided in an attempt to counter these impressions. This figure shows a complete file set up—consisting of initial, budget, growth, report, and constraint files—for a financial model of a fictitious four-year college.

figure 2. EFPM Data Files for a Sample Model

File 1 - Variable Names and First-year Values

```
 1  R                                  TOTAL REVENUE
 2  E                                  TOTAL EXPENDITURE
 3  S                                  BUDGET SURPLUS
 4  ST             1600                STUDENTS
 5  FAC                                FACULTY
 6  FSAL             25    18   2      FAC AVG SAL
 7  T                 2    18   2      TUITION
 8  OR             2000    18          OTHER REV
 9  OE             2000    18          OTHER EXP
10  GST             .10         3      GROWTH RATE OF ENROLL
11  GT              .05         3      GROWTH RATE OF TUITION
12  GFSAL           .06         3      GROWTH RATE OF FAC SAL
13  GOR             .05         3      GROWTH RAATE OF OTHER REV
14  GOE             .10         3      GROWTH RATE OF OTHER EXP
15  RATIO           9.4         3      STUDENT FAC RATIO
16  RT                                 REV FROM TUITION
17  ES                                 EXPEND FOR FAC SAL
18  INFLAT          .07         2      ONFLATIONARY RATE
```

File 2 - Budget Functions

```
 5 /  4 15
16 *  4  7
 1 + 16  8
17 *  5  6
 2 + 17  9
 3 -  1  2
```

File 3 - Growth Functions

```
4 G 10
8 G 13
9 G 14
6 G 12
7 G 11
```

File 4 - Report Contents

```
1 PRIMARY PLANNING VARIABLE (PVV) LIST
1  1   10  11  12  15  18   7 999

2 BASE YEAR BUDGET CALCULATION
2  2   16   8   1   0  17   9   2   0   3   0   5   6   0   7  15

3 FORECAST SUMMARY
3  3   16   8   1   0  17   9   2   0   3   0   5   6   4   7  15
```

File 6 - Constraint Data

```
3 SURPLUS        -5         5 1 -2  TURNS ON AT T=1 AND OFF AT T=2
```

Clearly such a model could be formulated and entered into the system, using the "model" subroutine, within a few hours. To complete the illustration, figure 3 shows a sample 5-year financial forecast from the same model.

figure 3. EFPM Forecast for the Sample Model

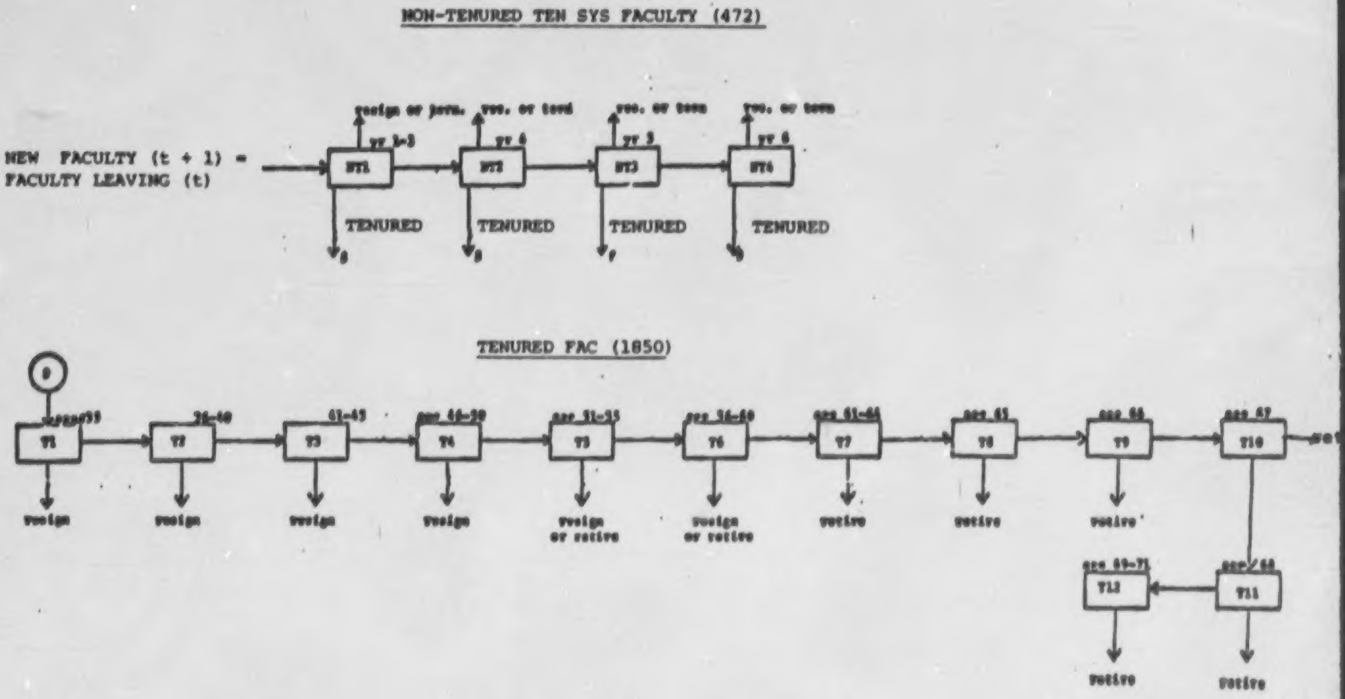
```
FORECAST SUMMARY

                         1979       1980       1981       1982        1983

REV FROM TUITION         3,200      3,942      4,857      5,984       7,372
OTHER REV                2,000      2,240      2,509      2,810       3,147
TOTAL REVENUE            5,200      6,182      7,366      8,794      10,519

EXPEND FOR FAC SAL       4,255      5,289      6,575      8,172      10,158
OTHER EXP                2,000      2,340      2,736      3,203       3,748
TOTAL EXPENDITURE        6,255      7,629      9,312     11,376      13,906

BUDGET SURPLUS         - 1,055    - 1,447    - 1,947    - 2,582    -  3,387

FACULTY                    170        187        206        227         249
FAC AVG SAL                 25.00      29.25      31.92      36.07       40.76
STUDENTS                 1,600      1,760      1,936      2,130       2,343
TUITION                      2.00       2.24       2.51       2.81        3.15
STUDENT FAC RATIO            9.400      9.400      9.402       9.400      9.400
```

Typically, a user would attempt to balance the budget by using the 'tradeoff' subroutine to find a solution value for some controllable variable, switching to the 'variable' subroutine to change the variable to the solution value, and then finally using the 'forecast' subroutine to once again obtain a revised 5-year forecast report. By repeating the iterative use of the three subroutines, the user could test various solutions to a single situation or find solutions to several hypothetical situations.

A Non-Standard Model - Faculty Flow

Now that we have seen how the EDUCOM system operates and have been provided a glimpse at the type of financial model generally analyzed using EFPM, we are ready to turn to the major theme of this presentation. If the example used in the preceding section—a fiscal forecasting model—may be termed the 'standard' usage of EFPM, then one may regard as being 'non-standard' those models that are neither a fiscal nor a forecast model. In this section, we look at an example of a model that simulates the simultaneous flow of faculty members through the tenure system and age categories, clearly a model with no fiscal components.

Figure 4 shows the structure of the model.


NON-TENURED TEN SYS FACULTY (472)
NEW FACULTY (t + 1) = FACULTY LEAVING (t)
resign or term.
res. or term
res. or term
res. or term
yr 1-3
yr 4
yr 5
yr 6
NT1
NT2
NT3
NT4
TENURED
TENURED
TENURED
TENURED
TENURED FAC (1850)
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
36-40
41-45
age 46-50
age 51-55
age 56-60
age 61-64
age 65
age 66
age 67
age 68
age 69-71
resign
resign
resign
resign
resign or retire
resign or retire
retire
retire
retire
retire
retire

The first row of stages represents the initial probationary period, of up to six years, which each entering professor serves before being considered for tenure. The second row of stages represents the tenured ranks and extends the usefulness of the model by subdividing this phase into age brackets through which we can simulate the flow of an aging faculty. Note that the first stage in the probationary status represents an entire 3-year appointment but that the second 3-year reappointment is broken down into one year stages. This was done to allow for promotion to tenure during the 4th, 5th, and 6th year of probation--an event that occurs only infrequently during the first three years. In this version of our model, we assume newly tenured faculty are always of an age less than 35; this is an unnecessary restriction that is used only for simplification. Finally, one should note that we are assuming a zero-growth policy, that is, the number of new faculty entering the system equals the total number of faculty leaving.

Such a model as this can be used to explore the effects that various personnel policies could have on three important considerations,

—the flow of new faculty into the institution
—the ratio of tenured faculty to total faculty
—the age configuration of the faculty.

For example, the user may wish to study the effects of three possible policies:

Policy 1: All faculty must serve the full 6 years in probationary status before being considered for promotion to tenure.

Policy 2a, b, c: The same stipulations as Policy 1 with an additional constraint that the proportion reeappointed at the end of the first 3 year probationary term is much reduced (40%, 50%, and 60%).

Policy 3a, b: Same conditions as Policy 1 except reappointment to a second 3-year probationary term is automatic and restrictions are shifted to the end of the 6 year probationary period, where promotion to tenure is constrained to be 40% and 50%, respectively.

Figures 5 and 6 are graphs that result from using the model to forecast the tenure ratio and flow of new faculty under the assumptions of the three policies.

figure 5.

EFFECTS OF VARIOUS TENURE POLICIES ON THE TENURE RATIO

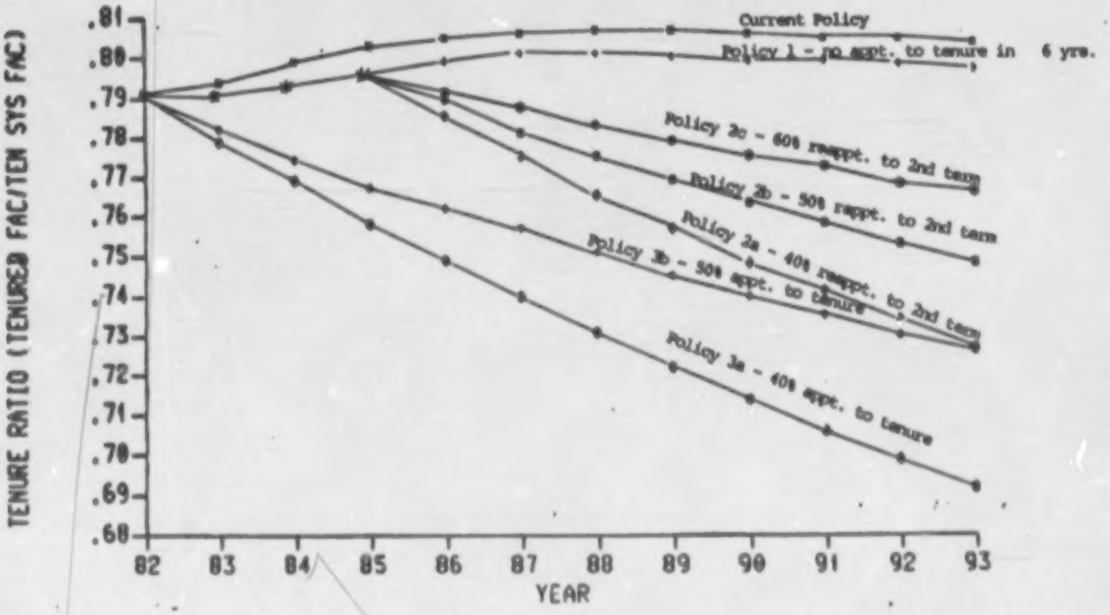
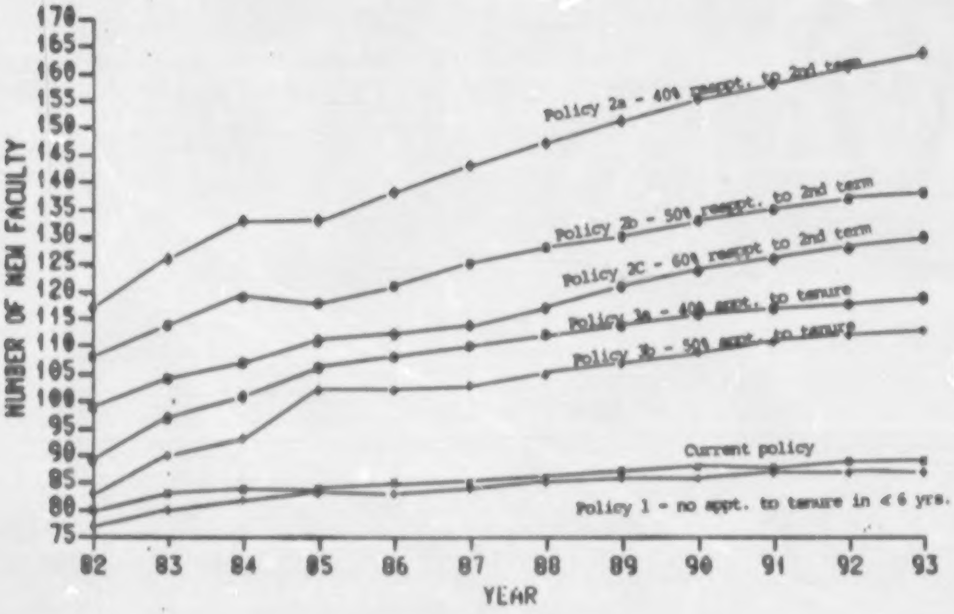


figure 6.

EFFECTS OF VARIOUS TENURE POLICIES ON THE FLOW OF NEW FACULTY



A question which immediately comes to mind is ´How much effort is involved in setting up the model for each of these very difficult options?´ The answer is ´very little´. For example, in order to alter the model from its normal conditions, as determined from historical data, to conditions reflecting Policy 1 requires:

```
Var: TRI: CHA: 33 0: 36 0: 39 0: 28 .28: 29. 29: 30 .99: 42 .83
```

to obtain a 12 year forecast:

```
!!!!! FOR:  TRI:  12
```

and to obtain the graphs for tenure rate and new faculty flow:

```
GRAPH: TWO:  2: 5
```

In order to demonstrate the full power of the EFPM system, we now take a somewhat different approach and in place of testing several policies, we shall attempt to arrive at a desired future configuration.

Problem 1: How can the tenure rate be reduced to .70 in 1992 by

a. adjusting the rate at which probationary faculty are promoted to tenure after 6 years service,

b. adjusting, simultaneously, the promotion rate (1) and the rate at which faculty receive reappointment to a second 3-year probationary term.

To answer problem 1a, we use the TRADEOFF subroutine to obtain a graph known as the ´impact graph´. Such a graph can be used to show the impact that predetermined values of one variable (here we use the rate of promotion to tenure with values 0 to 50%) will have on a second variable (tenure ratio). Figure 7 shows the resulting impact graph, from which we can see that a promotion rate of 34.5% will result in the desired tenure ratio of approximately .70 by 1992. The second graph in Fig. 7 is obtained from the FORECAST subroutine and shows that lowering the tenure promotion rate to 34.5% does indeed result in the desired tenure ratio.

figure 7. The Use of the Impact Subroutine to Obtain a Solution to Problem 1a

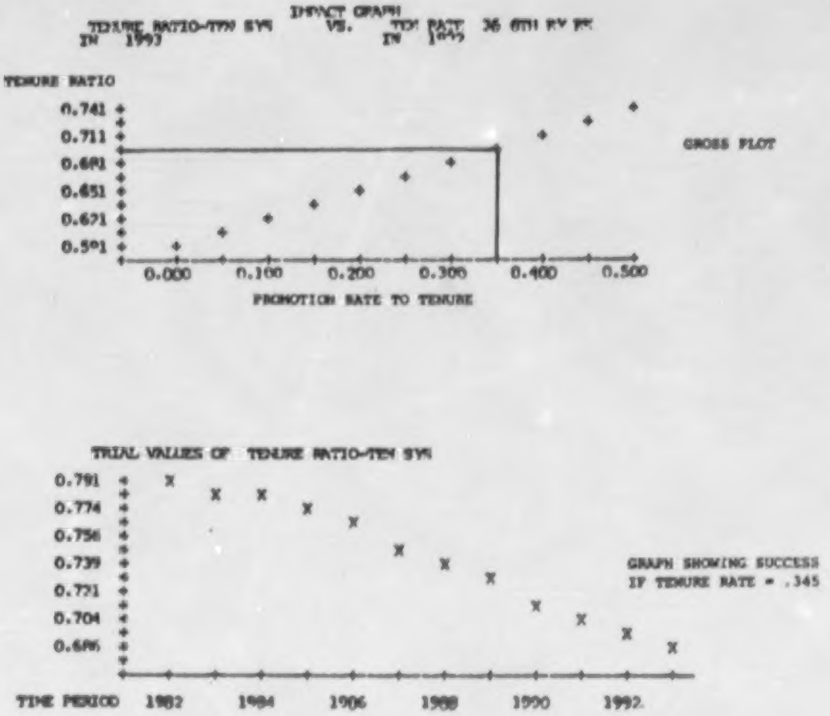
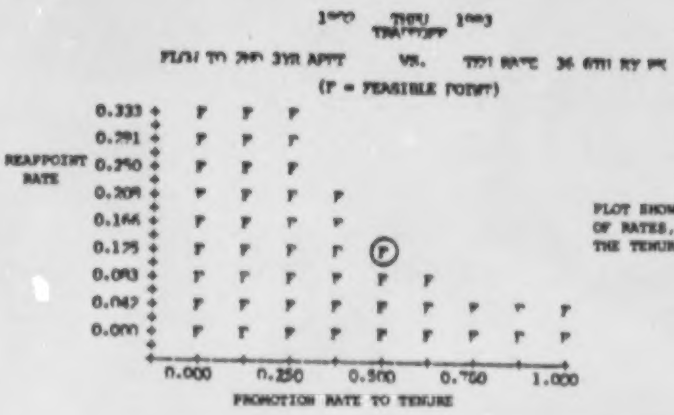
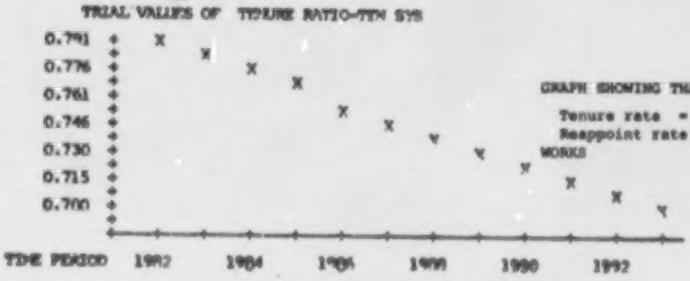


Figure 8 exhibits the graphical solution to Problem 1b as provided by yet another option available in the TRADEOFF subroutine. Each plotted ´F´ indicates a point which has x and y coordinate values that solve the problem. For example, the circled ´F´ has coordinates equivalent to setting the tenure promotion rate at 50% and the reappointment rate at 12.5%. This particular model option furnishes the user with a wide range of solutions. Further use can be made of the model to study the effect that each of these solutions will have on other variables, such as the flow of new faculty, from which the modeler will gain insight that will facilitate the selection of a solution which maximizes several desirable outcomes. Once again, it should be noted that these results are quickly obtained while the user sits at a terminal. Such interactive use can telescope a three week planning problem into a two hour session with all the principal administrators gathered together.

figure 8.



PLOT SHOWING ALL FEASIBLE PAIRS OF RATES, i.e., PAIRS THAT REDUCE THE TENURE RATIO TO .70



GRAPH SHOWING THAT THE PAIR:
Tenure rate = .50 (50%)
Reappoint rate = .125 (37%)
WORKS

A Second Non-Standard Model

Often a data manager is asked to set up a small scale management information system for the personal use of a policy-making administrator such as a Vice President for Academic Affairs. In a four-year college, such an administrator may even pose such a task for himself, particularly if he has some experience with computers. We assume further that the administrator knows the type of data elements he will be most interested in—say historical fiscal data—but he/she is unable to specify the ratios and other derived data that should be calculated, or even how they should be displayed. How is this project to be approached? Once the basic data is stored and a few preliminary reports are printed out, the programmer will probably be faced with a never-ending series of requests to alter the formats, delete or add new data elements, or provide totally new calculations. Such a situation arises not so much from an administrator's inability to decide what he wants, as much as the variety of problems, each calling for different information, that comes across his desk. The many 'user-friendly' software packages now on the market attest to the need for such executive support systems.

As long as the required data base is relatively small, the EFPM system provides a reasonable way around the programming difficulties, even though EFPM was designed to facilitate changing values of *variables* and not for changing the *equations* linking those variables, as required by this problem. However, one must remember that the EFPM system has a subroutine ('MODEL') which was designed to make the building of a model very easy. Since the construction of a model consists of nothing more than specifying the equations, it stands to reason that the MODEL subroutine could just as easily be used to modify, add, or delete equations.

In illustration of this use, consider the following case. The Academic Dean of a small four-year college, consisting of ten instructional departments, wishes to establish an historical data base for his own use. Not wanting to be bothered with trying to anticipate what ratios and other derived data may be needed, he decides to merely store the available data and rely upon the flexibility of EFPM to later define and calculate whatever additional data is required. As a desk top reference, he sets up a notebook showing the report number assigned to each department's data base and the variable numbers assigned to the data elements. For example, the page entry for the math department appears as figure 9.

figure 9. Reference Page for Math Department

Department Math
Report Number 6

Variable No.	Variable
51	FTE Faculty
52	Total Course Credits
53	Total SCH
54	Total Class Contact Hours
55	Organized class contact hours
56	Lower Division Majors
57	Upper Division Majors
58	Degrees Awarded
59	Salary Budgets
60	Total Budget
61-80	(Available for later use)

Assume now, that some months later the Dean is confronted wth a budget allocation problem related to the math department. He decides that he'd like to study the available data. After looking up the proper report number in his notebook, he takes a seat at his office terminal, establishes contact with his EFPM model and enters:

```
FOR: 5 : 6
```

The terminal printer then produces figure 10.

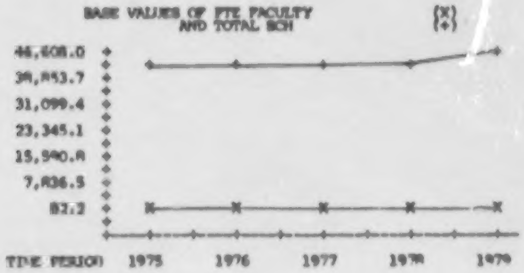
```
MATHEMATICS DEPT DATA BASE

                              1975       1976       1977       1978       1979
                              ----       ----       ----       ----       ----

FTE FACULTY                   82.2       86.2       89.1       92.1       92.1
TOTAL COURSE CREDITS         1,266      1,305      1,345      1,332      1,332
TOTAL SCH                   43,039     41,758     43,055     43,950     46,608
TOTAL CLASS CONTACT HRS      1,444      1,473      1,479      1,533      1,479
ORG. CLASS CONTACT HRS       1,399      1,261      1,338      1,346      1,406
MAJORS-LD                      122        127        103         67         67
MAJORS-UD                      207        179        159        134        121
DEGREES AWARDED                 91         68         79         57         40
SALARY BUDGET            2,080,599  2,211,967  2,331,979  2,556,436  2,821,022
TOTAL BUDGET             2,166,557  2,166,557  2,303,666  2,423,469  2,649,096
```

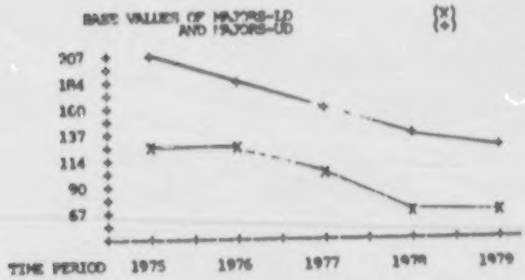
After looking at this data, the Dean decides that he could best use some of the data displayed in graphical form. He then requests graphs for variables

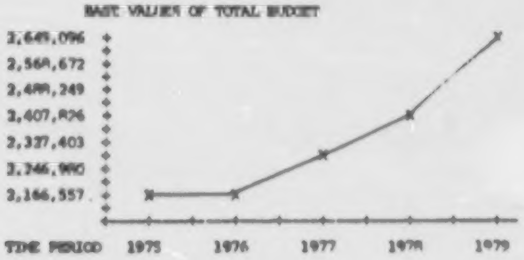
83

51,53, 56, 57 and 60 by entering:

GRAPH: TWO: 51: 53
| 56: 57
|| ONE: 60
This produces the three graphs in figure 11







The dean then decides that he would like to see some ratios that are not in the data base but which can be calculated from the stored variables. He wishes to produce the ratios SCH/FTE faculty (variables 53 / variable 51) contact hrs/FTE faculty (54 / 51), weighted average section size (53 / 52), and total budget dollars/SCH (60 / 53). In order to do this, he must use the MODEL subroutine to define these new variables representing the ratios; this is done by adding the definitions to the list already in the INITIAL file as follows:

```
MOD: INIT: DEF
61 RATIO 1 0 1 SCH/FTE
62 RATIO 2 0 1 Contact HRS/FTE
63 RATIO 3 0 0 Wt. Avg. Sect. Size
64 RATIO 4 0 0 Total $/SCH
```

All that then remains to be done is to add the defining equations for these new variables to the model's BUDGET file:

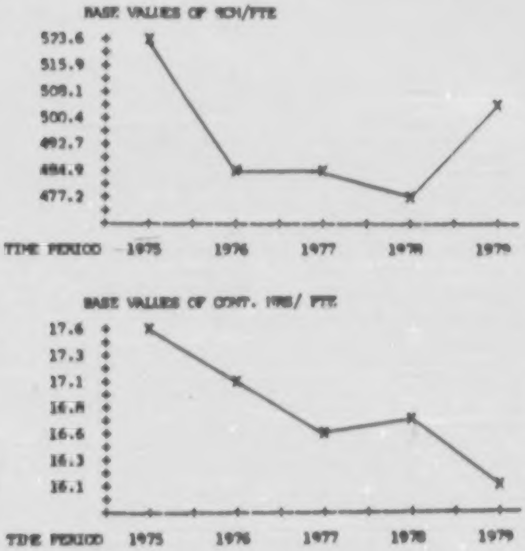
```
!!!!! MOD: BUD: DEF
61/53 51
62/54 51
63/53 52
64/60 53
```

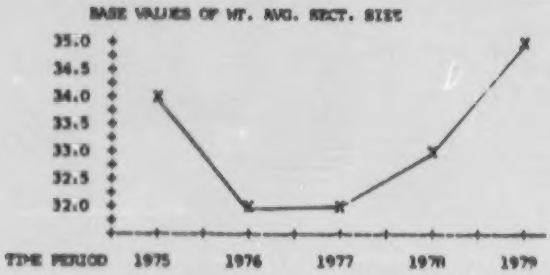
At this point, the new, derived variables are available upon call. If graphs are wanted, they can now be called by

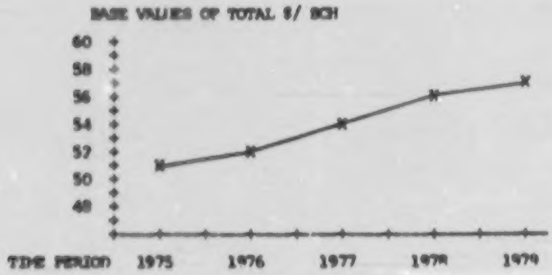
```
!!!!! FOR: BAS: 5
GRAPH: ONE: 61: 62: 63: 64
```

producing the graphs in figure 12

figure 12. EFPM Graphs







If, at this point, the dean decides that he would like to add these four new data elements to the data base printout, all he has to do is to modify the report format as follows:

```
!!!! MOD: REP: 6: ADD: BOTTOM 61 62 63 64
```

Of course, the programming instructions are all quite meaningless to anyone not acquainted with EFPM, but they do serve to demonstrate that nothing very complex is needed to add or change any calculations and to obtain trend graphs--nothing, in fact, beyond what a busy administrator could learn in less than an hour.

Conclusion

The two examples of non-standard uses of EDUCOM's Financial Planning Model system were intended only to demonstrate that the system is far more flexible in its adaptation to different situations than its name implies; it is hoped that this clarification will reach a broader audience and encourage other institutions to investigate the benefits which may be gained from this valuable tool. A few references are provided to give the interested reader an insight into some additional modeling efforts undertaken at other institutions.

TWO USES OF THE EDUCOM FINANCIAL PLANNING MODEL SYSTEM TO BUILD NON-STANDARD MODELS

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MISSISSIPPI APPROACH TO A STATE-WIDE MANAGEMENT INFORMATION SYSTEM: THE BEGINNING

by

Malcolm B. Lightsey, Director
Management Information System Project

Rick Clary, Director, Technical Services
Management Information System Project

Board of Trustees of State
Institutions of Higher Learning
State of Mississippi
Jackson, Mississippi

The eight public universities in Mississippi and the Board of Trustees are committed to the development of a state-wide management information system. This paper will describe the background for the project and duscuss the efforts and progress made during the first two years.

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The eight public universities in Mississippi and the Board of Trustees are committed to the development of a state-wide management information system. Funds for planning and development have been allocated by the State Legislature in response to the recommendation of consultants who performed a comprehensive study of management of higher education in Mississippi.

Background

A 1944 amendment to the Mississippi Constitution created the Board of Trustees of State Institutions of Higher Learning and charged it with the governance of all public senior colleges and universities in the state. These institutions and their primary campuses are: Alcorn State University, Lorman; Delta State University, Cleveland, Jackson State University, Jackson; Mississippi State University, Mississippi State; Mississippi University for Women, Columbus; Mississippi Valley State University, Itta Bena; University of Mississippi, University; University of Southern Mississippi, Hattiesburg. The Board also has been given control over certain other agencies and programs that conduct research activities.

Board members are appointed by the governor, confirmed by the senate and serve twelve-year terms with four terms expiring each four years. This structure encourages the independence of the Board in its management decisions and shields the universities from undue pressures.

In addition to the management and control of the universities, the Board and its staff work very closely with legislative leadership to assure adequate public funding for the universities. All state support for these institutions is appropriated to the Board and thence distributed to the universities according to the funding formula. Only a few special agencies and programs are separately funded.

In dealing with the universities, the Board and its professional staff practice the philosophy that the Board establishes the role and scope of each institution, then delegates to the executive head of the institution the authority and responsibility to administer the affairs of the institution. It is his responsibility to develop administrative leadership and to motivate a faculty which demonstrates imagination and initiative.

While it is desirable and necessary to achieve certain levels of uniformity and standardization, these efforts must also recognize that some diversity, innovation, imagination and competition are essential to the mission of institutions of higher learning.

Funding

In its 1978 session, the Mississippi Legislature appropriated funds to support a comprehensive study of the management of public higher education, including the junior colleges. The consulting firm and its subcontractors spent about a year in the study, issuing a series of interim reports. The final report, entitled "Pathways to Accountability and Excellence," was issued in early 1979. Among its many recommendations was a strong argument for the Legislature to support the planning and development of a state-wide management information system. Both the 1979 and 1980 sessions of the Legislature appropriated funds ($700,000 each year) for this purpose and set January 1, 1983, as the date for the project to be completed.

A request of $1,500,000 for FY82 was reduced to $955,000 by the Legislature and the Budget Commission. At this level, the completion date must be delayed until January 1, 1984.

Objectives

There is a clear mandate from the Mississippi Legislature to develop a comprehensive and uniform management information system for the Board of Trustees which encompasses virtually all of the administrative functions at each of the public universities in the state. The Legislature recognizes that this system is essential if the Board of Trustees is to fulfill its responsibility to provide efficient and informed management of the institutions. Through the appropriations process, the Legislature has clearly stated its support for the idea that more and better information is needed in order to make the difficult decisions we face in the coming years.

The Board of Trustees' perception of the objective of the project differs slightly from that of the Legislature. There is agreement on the concept that uniform or standard information is required, but the Board is more aware of the individuality of the institutions and the need to retain flexibility in some situations. There is complete agreement that the Board's professional staff needs better and more timely information in order to meet the demands of the Board and the Legislature.

Still a third perspective of the objectives prevails at the universities and is clearly different in nature from the others. While in agreement that more consistency and uniformity are needed in some instances by the Board office staff, university personnel generally believe that the central objective should be to assist the universities in their efforts to develop management systems which can respond to requests from the Board office.

The MIS project staff is addressing each of these objectives, but recognizes that considerable emphasis must be placed on the institutional perspective if the other objectives are to be met. This recognition will be addressed in a later section.

Organizational Dynamics

Three particularly important factors have governed the organization of the project from its inception. In order of importance, these are: "top-down" management support, extensive involvement of university personnel, and flexibility in structuring the project team.

"Top-down" management support began with the decision of the Mississippi Legislature to fund the project. This action clearly documented the opinion of key legislators that uniform and comprehensive information is necessary to meet the challenges of the future. The Board of Trustees also recognized the benefits of the proposed system and gave its support to the project.

The key to the success of the project is the support of the executive officers of the eight universities. They became involved because the Board had endorsed the project. Each of them has become much more informed on the complex issues surrounding computing and information management on his campus. This knowledge has evolved into support for the MIS project, and perhaps more importantly, has created a more sympathetic environment for data processing on the campuses.

In the Mississippi environment, the ultimate success of any state-wide MIS depends upon the continued support of management at all levels; the project would have no chance of success otherwise.

The second factor, involvement of university personnel, has been emphasized every step of the way. There are any number of reasons why this involvement is essential, so only four of the more important ones are listed here.

1) A vast reservoir of talent and knowledge exists in the staffs of the universities.
2) Those who are involved in any effort are more likely to be supportive. Our experience indicates that deeper involvement generates stronger support.
3) On every campus there are persons who are aware of many important issues which cannot and should not be addressed by the Board of Trustees staff.
4) The state-wide MIS data base will be only as good as the data submitted by the universities. The quality and timeliness of data are limited by systems in place at a university. Any effort to improve university reporting systems must necessarily involve persons from every part of the university.

Institutional personnel have been involved in four major roles: planning, setting policy, communication and work sessions. The original MIS pre-planning committee included representatives from five universities.

That committee has evolved into the MIS Steering Committee which includes one vice president or equivalent from each university. This committee, with input from the institutional executive officers, is responsible for overall planning and policy for the project.

Each campus has established an MIS task force and assigned one person to be the institutional representative. This person, usually the Director of Institutional Research, is the focal point for all communication between the campus and the MIS staff. Correspondence is routed through his office, and he coordinates all meetings related to the project.

Work committees and subcommittees have been established when specific tasks must be accomplished. These committees are usually empaneled to address a limited set of problems and disbanded immediately upon completion of the work. The committees have assisted in dozens of tasks such as developing software requirements, evaluating vendor proposals, designing or revising final specifications, defining data elements and reviewing detailed system designs.

The third major factor, flexible project team structure, is absolutely essential in order to meet the dynamic changes in requirements which occur almost weekly.

The current full-time staff is composed of persons from widely varied backgrounds. About half the professional staff have data processing backgrounds. Others come from accounting, registrars' offices, personnel, payroll and institutional research. Each one has added a special skill to the team and provides experience which helps other staff members better understand the university environment. The flexibility to attract persons with these diverse backgrounds is essential.

Consultants have been used when special expertise was required. University staff members with particular skills have also been available for short-term assignment when needed.

Determination of Needs

The first phase of the project was begun by the Pre-Planning Committee and focused on the effort to identify the information management needs of the Board of Trustees. With help from local IBM representatives, the committee applied the rather formal IBM business planning procedure to develop the definition of needs.

Over a period of about three months, during which a project director was employed, various work groups and committees identified the "data base" needed by the Board of Trustees staff to meet its responsibilities. Almost 200 man-days were expended by personnel from the universities, Board staff and IBM. This "data base" was initially a list of some 400 commonly used "report data elements" covering the functional areas of personnel, finance, budgeting, students, curriculum and facilities.

This initial list was reduced to about 250 elements as part of the effort to derive uniform definitions which are acceptable to the eight universities. About 300 man-days were expended by university and Board office personnel in reaching concensus definitions of about 240 of the elements. Resolving definitional differences is the objective of a current effort to complete the dictionary.

Once the reporting data elements are identified, it is also necessary to define the timetable and the format for all reports. An MIS Policy and Procedure Manual, now in draft form, has been developed as the document to guide all reporting activities. This manual sets reporting schedules, specifies media (printed reports, magnetic tape), sets forth policy and defines procedures for changing requirements. A key part of the manual explains the proposed usage of machine readable data and controls on the use of that data.

The Policy and Procedure Manual and Reporting Data Element Dictionary combine to form the foundation of the Board of Trustees Management Information System. A major thrust in FY82 is to define the specific computer programs required to convert the data into information for the Board, the Legislature and the general public.

Evaluation of Current Status

Following the completion of the first "final" version of the Reporting Data Element Dictionary, it was clear that several universities were enormously different in their ability to adhere to the definitions and reporting requirements inherent in this document. Perhaps of equal importance, each university had its own perception of the quality and responsiveness of systems on its campus. These perceptions were usually based upon limited exposure to systems at other universities.

A consultant firm, Alexander Grant and Company, was engaged to provide a standard evaluation of each institution's ability to collect, maintain and report the data elements included in the dictionary. In almost every case, the consultants concluded that existing procedures and computer systems could not effectively respond to Board requirements. Many of the systems required so many changes that the only practical action was to replace them with software packages and improved user documentation.

The consultant's report documented the need for the universities to upgrade their management systems so that timely and accurate data could be reported. Clearly, the usefulness of any MIS for the Board office is dependent upon the integrity of data submitted from the campuses.

Overview of Effort Required

The consultant report included an estimate that about 59 man-years of effort will be required to replace the deficient computer systems and procedures on the campuses. Additionally, some three to four man-years will be required to complete the Policy and Procedure Manual, the Reporting Data Element Dictionary and the computer programs to be used by the Board of Trustees staff.

The major effort is obviously the implementation of computer software on the various campuses. The consultant's report and subsequent effort by the MIS project staff have clearly defined the systems and sub-systems which are critical to the project. These have been addressed as four major systems:

1) Human Resources Management, consisting of payroll, personnel, position control, personnel budgeting and labor cost distribution;
2) Financial Accounting, consisting of general ledger, budgeting and budget modeling;
3) Fixed Assets Accounting, consisting of property inventory, building and land inventory, and building utilization; and
4) Student Information, consisting of pre-admissions, admissions, registration, records and financial aid packaging.

A complicating factor is the requirement that these systems must operate on a variety of computer hardware and operating system software. Equipment from IBM, Xerox, Univac and NCR is used and must support these packages.

The Board of Trustees Management Information System involves three primary components:

1) The MIS Policy and Procedure Manual discussed earlier is the key to the system. It is currently in rough draft form and will be completed during the next few months.

2) The Reporting Data Element Dictionary contains all the terms which must be uniformly defined and reported as specified in the Procedure Manual. The document has been published as a first edition but must be revised to include changes which have arisen over the past year. A most difficult and sensitive problem will be to resolve definitional differences which still exist because of strong and differing policies or opinions from one campus to another. This document is also scheduled for completion within the next few months.

3) The programs required to process data in the Board office must be developed. These will be written using the Statistical Analysis System (SAS). Approximately one hundred programs are planned to meet the analysis and reporting needs which have been defined at this time. The programs are scheduled for completion by July 1, 1982.

Search for Software

After the decision was reached that the MIS project should provide administrative systems software for the universities, we developed a plan to guide the acquisition process. In Mississippi the procurement process for computer hardware and software for state agencies and institutions is overseen by the State Central Data Processing Authority. They were involved from the beginning and were a great help in expediting the process.

As discussed in the section on Organizational Dynamics, we were careful to involve university personnel at every step of the way, especially in this one.

In addition to involving these people, the plan included developing and evaluating requests for proposals, questionnaires to universities in other states and a review of programs in the College and University Systems Exchange (CAUSE) Library.

In developing the Requests for Proposals (RFP), we made the basic assumption that we would not consider any vendor with fewer than five active installations. This decision allowed us to forego the detailed specifications for basic systems and to concentrate on those factors which make Mississippi unique.

Before the "uniqueness" factors were finalized, teams visited each campus for several days to meet with senior staff members responsible for the functional areas to be addressed. The results showed that each university desires to perform the same functions as the others and usually in almost the same manner. Much of the fear of "institutional differences" dissipated during this process.

The vendor responses to the RFP's were less numerous and more expensive than expected. The process of evaluation included forms for comparative analysis, vendor presentations and site visits. University personnel were involved in each aspect and made major contributions to the effort.

The final result of the RFP effort was to purchase one system, the

Human Resources Management System, from Integral Systems, Incorporated. Other proposed packages could have addressed our needs in other functional areas, but funds were not available to purchase them.

Concurrent with the RFP process, we prepared and distributed a questionnaire to universities in some 40 other states, based upon consultant recommendations. The questionnaires were distributed through the offices of state boards or agencies similar to the Mississippi Board of Trustees and were not always passed along to the appropriate person. The resulting response from about fifty universities was good but could have been better with a more thorough analysis of the mailing list. Because of our multiple hardware environment, very few of the responses were considered with any seriousness.

One response to the questionnaire came from the Board of Regents of the State University System of Florida. We had already become interested in their system through a visit to CAUSE. After a visit to their offices, we decided to use two of their systems, Financial Accounting and Property, as the bases for our Financial Accounting and Fixed Assets Systems. In the process of system definition and design, we have now discarded their Financial System as our base, but we have incorporated many of their concepts and some reports. Their Property System remains the base for our Fixed Assets.

The search for a Student Information System was frustrating and fruitless. At least two vendors offer such systems, but they were priced beyond our resources. The basic system purchased from Integral Systems, Incorporated, was used as the foundation for the student system. The first installation is scheduled for spring of 1982.

Plan of Action

Much of the basic policy and operational philosophy of the MIS is now clear. What remains is to put in place the tools needed for the universities to provide data and for the Board office staff to process that data.

Because of the Board of Trustees policy that responsibility for administrative decisions rests with the executive officer of the university, there is no requirement for any university to accept any software package offered by the MIS project. Each university is free to select its own method of responding to the reporting needs set forth in the Policy and Procedure Manual.

The first campus installations are well under way at the "pilot" sites. Approximately ten (10) installations will be completed during FY82 with fifteen (15) installations planned for FY83.

At the Board office, the effort will be concentrated toward completing the Policy and Procedure Manual, Reporting Data Element Dictionary and the hundred or so computer programs which must be designed and written. A significant effort is also planned to document all portions of the system.

Long Range Plans

Although most of the planning and effort expended thus far have focused on the short-term (4-year) project to develop an MIS, it is immediately obvious that all these activities have enormous potential for long range impact on higher learning in Mississippi. Some of the most important ramifications are as follows:

1) Common computer software on all campuses can be maintained and updated through a central staff to reduce both cost and potential

for errors. Flexibility in these systems also offers improved ability to respond to new requirements.

2) Uniform and comprehensive information in the Board of Trustees office will allow a well-planned approach to the problems expected in the decade of the eighties. The system as envisioned will be flexible enough to meet any demands we can anticipate.

3) The programs offered by the MIS project will form a solid base for a campus management information system should any university decide to develop one.

The development of a comprehensive long range plan for the utilization of management information either at the universities or at the state level must await a growth in the level of "computer sophistication" at the highest management levels. The MIS project has provided a vehicle to begin to travel this growth curve, but real understanding comes only with day-to-day usage. Consequently, a long range plan is probably outside the scheduled project completion date.

Conclusion

The goal of a state-wide MIS for the institutions of higher learning in Mississippi is well defined and reasonable. Plans, the framework, are in place; only a lot of very hard, sometimes creative and probably frustrating, work remains. Goals and objectives have been set ambitiously; so far they have all been achieved.

The single most important factor for success is "top-down" management support. Funding is also essential but will be useless without management commitment.

With the continued support of the Legislature, the Board of Trustees and the executive officers of the universities, the project staff will continue to progress at a pace not usually found in public institutions or agencies. Time will tell whether that support continues, and the next chapter of the Mississippi Approach will document our progress and experiences in this exciting undertaking.

The Evolution of Information Systems in Higher Education:

A Review of Two Major Studies

Richard L. Mann
University Director
Institutional Research/Information Systems/
Personnel Services
University of Kansas

Robert E. Russell
Manager
Purchasing Stores, Operations
University of Michigan

References

Mann, Richard L. "A Study of the Development of Computer Based Management Information Systems in Institutions of Higher Education." Ph.D. dissertation, University of Illinois, 1974. (Xerox University Microfilms Publication No. 74-14577).

Russell, Robert E. "Computer-Based Decision Support Systems in Higher Education: The Support, Development, and Impact of MIS." Ph.D. dissertation, The University of Michigan, 1981. (Xerox University Microfilms Publication No. 81-25194).

This presentation is based upon two studies which were conducted in 1973 and in 1981. The initial study was conducted by Dr. Mann as part of his dissertation research in the development of management information systems in institutions of higher education. Dr. Mann focused on institutions with more than 2,000 students. Dr. Russell conducted a similar study using portions of Dr. Mann's survey material as part of his dissertation research in 1981. The following pages represent some highlights and some findings of these two studies concerning the development, implementation and use of management information systems in higher education.

Use of Administrative Computers

	1973	1981
Dedicated on-site	23.5%	25.1%
Dedicated on-site with facilities management	----	2.9%
Combination	67.9%	56.0%
Off-site consortium	3.7%	9.7%
Off-site services	4.0%	3.9%
No	1.6%	0.0%
Other	----	2.5%

The comparative data indicates that in 1981 there has been an increase in dedicated on-site administrative computer and/or management information systems departments and a decrease in combined administrative/research-instructional computer centers. This may be due in part to the growth of administrative computing generally and possibly resources and/or security issues within the institution. Another factor which deserves note is that 36 institutions in 1981 reported dedicated on-site facilities management. There are a number of companies which provide either partial or full management services for administrative and academic computer centers. This seems to be a growing alternative in the eyes of many institutions, particularly in light of the shortage of skilled data processing personnel.

Institutions Reporting Use of Information Systems

	1970	1973	1981
Public	27.0%	39.9%	48.0%
Private	30.0%	40.5%	44.1%

In 1970 Lawrence Bogard conducted a brief study of management information systems on which the 1973 and 1981 studies are partly based. It is interesting to note that public institutions have shown a faster growth over the past 11 years than have private institutions in their partial or full operation of management information systems.

Status of Information Systems Activity

	1973	1981
No plans for development	7.2%	8.3%
Undecided	6.3%	5.1%
Intend to develop a plan	17.7%	16.4%
Total No	31.2%	29.8%
Presently planning	28.1%	22.9%
In partial operation	40.0%	39.8%
In full operation	0.7%	7.5%
Total Yes	68.8%	70.2%

Overall, the total number of institutions who indicated that they had no plans to develop management information systems was essentially unchanged. Where a change was noted was a movement from "presently planning" to in "full operation" which indicates that some significant progress has been made by a number of institutions fully implementing their management information systems.

Status of Information Area in Information Systems

Student Information

	Not Under Consideration	Planning to Include	Currently being Implemented	Fully Implemented
1973	0.3%	28.0%	48.5%	23.2%
1981	0.9%	26.7%	38.5%	33.9%

Student information was shown as being the most advanced in terms of implementation in all institutions. Clearly, development of student related information systems appears to have the highest priority in the majority of institutions reporting.

Status of Information Area in Information Systems

Financial Information

	Not Under Consideration	Planning to Include	Currently being Implemented	Fully Implemented
1973	0.7%	42.0%	41.4%	23.2%
1981	3.2%	35.0%	37.9%	24.0%

Financial information appears to be the second most important in terms of implementation. A curiosity here is the fact that there has been some growth in those schools reporting not considering developing a financial information system. It is unclear why this is the case.

Status of Information Area in Information Systems

Staff Information

	Not Under Consideration	Planning to Include	Currently being Implemented	Fully Implemented
1973	2.0%	42.5%	44.5%	11.0%
1981	3.7%	38.9%	37.5%	19.0%

There appears to have been some growth in the full implementation of staff information systems in 1981 as compared to those reporting in 1973.

Responsibility for Information Systems

	1973	1981
General Administrative Officer	9.6%	6.2%
Institutional Research/Planning	23.1%	14.7%
Data Processing or MIS	40.6%	57.0%
Administration, Finance, Business Affairs	19.2%	10.9%
Academic, Student, Instructional Affairs	3.2%	1.3%
Committee or Task Force	0.7%	3.2%
No one assigned	3.6%	6.7%

The emergence of the administrative data processing, or MIS function, as a separate department is reflected in the comparative data reported above. Much of the responsibility for the development of management information systems has moved away from offices of institutional research and from financial and business affairs departments to the MIS or data processing organization.

Reporting Authority for Information Systems

	1973	1981
President	46.2%	37.5%
Chief financial, business, or planning officer	34.5%	48.6%
Chief academic officer	6.8%	3.2%
Executive Vice President	5.3%	4.2%
Director of Research/D.P.	3.4%	1.7%
Other	3.8%	4.8%

The decrease in the number of schools reporting that their management information systems department reports directly to the president suggests that management information systems have become more of a routine operation and now report to one of the functional vice presidents, most often the chief fiscal or planning officer.

Source of Data Elements

	1973	1981
Institution	26.4%	58.6%
WICHE/NCHEMS	35.8%	15.1%
State or System-wide	16.8%	14.8%
Institution-map to NCHEMS	4.6%	----
Combination	15.7%	----
Other	0.7%	11.5%

The most significant aspect in the use of data elements reported is a significant decline in the use of NCHEMS' data element definitions as a standard for establishing data commonality. A significant increase in the number of institutions which reported in 1981 that they were using their own standards and a similar decline in the number of schools indicating they are not using NCHEMS' standards contrasts with those reporting in 1973 when the NCHEMS data definitions appeared to be much more of a factor.

Use of Retrieval Systems

	1973	1981
Planning	50.0%	40.2%
In operation	36.8%	57.7%
No plans	13.2%	2.1%

A significant jump in the number of institutions now operating retrieval systems as part of their management information systems is reflected in the 1981 responses.

CBMIS Impact on Decision-Making

	% Increased		% Unchanged		% Decreased	
	73	81	73	81	73	81
Centralized Decision-Making by Administration	41	38.8	51	56.7	8	4.5
Managerial vs Political Decisions	70	54.4	29	42.8	1	2.8
Faculty Role in Decision-Making	24	19.5	75	78.6	1	1.9
Student Role in Decision-Making	13	7.1	86	91.5	1	1.3

In general, the impact of management information systems on decision-making has not significantly changed since the survey in 1973. There seems to have been a drop, however, in the number of schools indicating in 1981 that managerial decisions are now more likely as a result of having a management information system. This was reported as being a significantly increasing factor in 1973. It is also interesting to note that the faculty and student roles in decision-making also appear to have remained unchanged.

CBMIS Impact on Organization

	% Increased		% Unchanged		% Decreased	
	73	81	73	81	73	81
Number of Administrative Levels	7	8.1	85	85.2	8	6.8
Size of I.R. or Planning Staff	34	23.4	62	71.1	4	5.6
Size of ADP or MIS Staffs	52	48.3	44	43.3	4	8.4
Size of Support Staffs	8	13.6	76	72.4	16	14.0
Size Total Administrative Staff	20	22.9	66	64.7	14	12.4
Number of Administrators with Quantitative or Computer Background	47	38.6	62	60.4	1	0.9

For the most part, there has not been a significant change in the organizational impact of management information systems over the period covered by the two studies.

Some of the More Relevant Comments From the 1981 Survey

"Our MIS is rudimentary but our office secretary is efficient and shows initiative."

"I am scrambling through a jungle of stereotypes, predispositions, enlightened newcomers, and a myriad of other persons and problems to get MIS started. SEND HELP."

TRACK II
MANAGING THE INFORMATION SYSTEMS RESOURCE

Coordinators:

Thomas W. West Ray Clark

California State University

George Pidot
Temple University

Robert P. Bostrom
Indiana University

Stephen S. Roberts
Catholic University

The Nature of Managerial Work

Ronald S. Clemens
Stanford University
Stanford, California

"If we do not understand what constitutes the top manager's job, how can we measure the impact of the computer on his work? In fact, how can we design useful management information systems or planning systems for him? If we do not know what managers do, how can we claim to teach management to students in business schools? How can we expect management development programs to improve the performance of practicing managers? And, if we cannot influence the way managers work, how can we hope to enable our large bureaucracies to cope with problems that today appear insurmountable?"

[Author's note: This is the script that was used at the CAUSE presentation. It lacks audience participation and ad lib's. Read Henry's book to get the full benefit.]

HENRY MINTZBERG

THE NATURE OF MANAGERIAL WORK

HARPER & ROW, NEW YORK, 1973

*****

Ladies and gentlemen,
peers and colleagues,
friends and neighbors,
fellow information system enthusiasts,
thank you for coming this morning.

*****

This is a book review. Book reviews are often very dull. The classic review is from a fourth-grader who wrote: "This book told me more than I ever wanted to know about rats."

I have three objectives -

- FIRST, to encourage you to read Henry's book. If you like it, you will love his second, The Structuring of Organizations.
- SECOND, to suggest one more context in which you could understand your job and the job of other managers.
- THIRD, to suggest that, if Henry speaks truth, the difficulties many of us are having supplying information system products to clients who are managers are real difficulties. The nature of their work is such that our current tools don't quite do the job.

*****

Henry's book is the best management textbook I have ever read.

It has helped me in my work--not changed my life, of course--but helped me understand what it is that managers do.

One definition: A manager, for the purposes of this book, is anyone who manages a group or organization, a range that reaches from a first-level supervisor to an organization's chief executive officer.

****
Let me check that most of you meet the prerequisites for this presentation.

Hands, please --
-- First, how many of you are now or have ever been a manager?
-- Second, how many of you believe that you report to at least one manager?
-- Third, how many of you provide information system products or services to clients and customers who are managers?

Good. I think we can safely continue.

*****
In his introduction, Henry says: [READ from 'abstract,' page 3]
*****

Henry made one mistake. He's a little restrictive on gender. But his facts are accurate, his research is sound, his synthesis is excellent and his prose flows easily--so I hope you will bear this oversight when you read his book.

I don't plan to take questions as we go along. I'm going to tell you everything I know. Questions would embarrass me. However, if you have comments, and you absolutely can't restrain yourself, just blurt it out.

*****
Henry starts off with a review of the literature, categorizing it into the eight 'schools' you see listed here.

You already know most of this if you are a hard-core management scientist, or know some of it if you occasionally read Peter Drucker in the john.

The material covers the ground from the Classical School--PODSCORB and that stuff--to the Work Activity School--where diaries have been kept on managerial activities by empiricists relying on inductive research.

We will move quickly past the schools; you can read this part at your leisure.

SCHOOLS

o CLASSICAL	o LEADER EFFECTIVENESS
o GREAT MAN	o LEADER POWER
o ENTREPRENEURSHIP	o LEADER BEHAVIOR
o DECISION THEORY	o WORK ACTIVITY

*****

Henry presents some of his conclusions up front in the book.

He concludes that managerial jobs are remarkably alike.

Obviously, there will be different specialized contents in the work of

- the Manager of Internal Audit
- the Director of Personnel
- the Vice-President for Developemnt
- the Dean of Undergraduate Studies
- the Director of Financial Aids
- the Dean of the Chapel

and - the Chairman of Petroleum Engineering

Henry believes that all of these jobs share six distinguishing characteristics and ten roles. It's these six characteristics and ten roles that we'll briefly consider this morning.

*****

It's lucky for us that these jobs have something in common. If they didn't, it would be hellishly hard to justify the cost of developing a particularized information system for each individual manager.

We've developed applications and 'transaction processing' systems for most of these departments. We have accepted, edited, stored, sequenced, summarized, and reported some data and numbers in a variety of systems over the years.

But information systems have had little impact in areas where the work is "nonprogrammed"--doesn't have an algorithm to describe it--and where the worker spends considerable time operating in a generalist mode.

There should be something useful we can do because managers depend on information. And we are the experts on information machines.

*****

These other conclusions are also on Henry's list.

CONCLUSIONS

- JOBS ARE REMARKABLY ALIKE
- WORK IS CHALLANGING AND NONPROGRAMMED
- MANAGER IS BOTH GENERALIST AND SPECIALIST
- MUCH POWER DERIVES FROM INFORMATION
- OCCUPATIONAL HAZARD IS SUPERFICIALITY
- NO SCIENCE IN MANAGERIAL WORK
- MANAGER IS IN A LOOP
- MANAGEMENT SCIENTIST CAN HELP
- MANAGERIAL WORK IS ENORMOUSLY COMPLEX

Here are the 6 distinguishing characteristics.

FIRST, since the manager's job carries responsibility for the organization's success, his work is never finished. There is always more to be done or that could be done. The backlog can get enormous. A manager can feel weeks or months behind.

SECOND, there is little specialization and concentration in managerial work. Many issues are handled in very short time periods. Significant and trivial activities mix and interrupt each other. Superficiality is required. Eventually it becomes a preference: a manager doesn't want "all the gory details."

THIRD, managers tend to choose activities that are non-routine, current, specific and well-defined. They like live action. As they deal with very current information, they run into layers of gossip and hearsay.

FOURTH, verbal communication is the preferred mode for a manager. She prefers the phone, scheduled or unscheduled meetings, tours or rounds as ways to communicate. Documented communications--mail and memos--stack up in the in-basket.

FIFTH, most of the manager's time is spent in communication:

- less than one-fifth goes to superiors;
- as much as one-third goes to subordinates;
- more than a third goes to horizontal, lateral and external communications.

SIXTH, managers do not control their own affairs and work. Much as they try, their calendars get filled up. A manager can exercise two degrees of freedom in control of her work. She can make initial decisions which define long-term committments, and she can use for her own purposes the activities in which she must participate.

So, these are the six, common distinguishing characteristics.

DISTINGUISHING CHARACTERISTICS

- MUCH WORK AT AN UNRELENTING PACE
- BREVITY, VARIETY AND FRAGMENTATION
- PREFERENCE FOR LIVE ACTION
- ATTRACTION TO VERBAL MEDIA
- COMMUNICATIONS - SUPERIORS, OUTSIDERS, SUBORDINATES
- BLEND OF RIGHTS AND DUTIES

Henry also has a good list of the six basic purposes of a manager.

They are thrown in here, without comment, in case you need some high-level help the next time you must write your job description.

BASIC PURPOSES

- ENSURE EFFICIENT PRODUCTION OF SPECIFIC GOODS OR SERVICES
- DESIGN, MAINTAIN STABILITY OF OPERATIONS
- TAKE CHARGE OF STRATEGY MAKING; ADAPT ORGANIZATION TO ENVIRONMENT
- ENSURE ORGANIZATION SERVES THOSE WHO CONTROL IT
- SERVE AS KEY INFORMATIONAL LINK TO ENVIRONMENT
- OPERATE ORGANIZATIONS STATUS SYSTEM

We move on to the ten roles: 3 are interpersonal, 3 are informational; 4 are decisional.

Since I first read this book about five years ago, I've come to believe that the roles are real. I observe them in my own activities and behavior and in that of other managers. (Right now I'm operating in one of the interpersonal roles, liaison.)

If you want some words to tie the roles together conceptually, they go like this:

> In his interpersonal roles the manager develops relationships which allow him, in his informational roles, to gather (and distribute) information on which he can base choices in his decisional roles.

TEN ROLES

- 3 INTERPERSONAL
- 3 INFORMATIONAL
- 4 DECISIONAL

Three roles are interpersonal: figurehead, liaison and leader. These roles derive from the manager's authority and status.

INTERPERSONAL ROLES

- FIGUREHEAD
- LIAISON
- LEADER

The figurehead role is usually ceremonial: the opening address, introductions, being in the photograph, bestowing an award.

And the cutting of the ribbon on the new 4 megs of main memory--embarrassing when the 4 megs slips thru the fingers and goes down a crack in the floor.

FIGUREHEAD

- FORMAL
- CEREMONIAL
- INSPIRATIONAL
- STATUS-RELATED

In the liaison role, the manager deals with groups and individuals ourside of his immediate organization. He provides a linkage between his organization and its environment. He "keeps the channels open." In media terms, he seeks "exposure" for himself and his organizations. A fellow named Leonard Sayles defines the liaison role in this way:

> "The one enduring objective of the manager is the effort to build and maintain a predictable, reciprocating system of relationships."

LIAISON

- HORIZONTAL RELATIONSHIPS
- ORGANIZATIONAL LINK TO ENVIRONMENT
- BUILDING AND MAINTAINING A PREDICTABLE RECIPROCATING SYSTEM OF RELATIONSHIPS

The leadership role--relations between the leader and the led--has received the most study. You'll recollect that 3 of the 8 schools listed on an earlier slide had "leader" in their names. Formal authority gives the manager potential power; leadership determines its realization. A leader encourages a cooperative enterprise which integrates individual needs and organizational goals.

How many of you work in an immediate group of people which you could characterize as a "cooperative enterprise."

LEADER

- INTERPERSONAL BETWEEN THE LEADER AND THE LED
- COOPERATIVE ENTERPRISE
- EFFECTS AN INTEGRATION BETWEEN INDIVIDUAL NEEDS AND ORGANIZATIONAL GOALS

The manager has three informational roles: monitor, disseminator, and spokesperson. The monitor acquires information; the other two roles distribute it.

The roles derive from the manager's special access to external information and his (theoritically) unlimited access to internal information.

INFORMATIONAL ROLES

- MONITOR
- DISSEMINATOR
- SPOKESPERSON

The monitor role inputs information from everywhere. The manager "...seeks information in order -

- to detect changes,
- to identify problems and opportunities,
- to build up knowledge about his milieu,
- to be informed when information must be disseminated and decisions must be made."

(Some monitors: cloakroom-, crosswalk-, TV-, and a former class of heavily-armed, iron-clad, naval steam vessel riding low in the water.)

Henry catagorizes information received by the monitor into 5 classes: internal operations, external events, analyses, ideas and trends, pressures.

MONITOR

- TO DETECT CHANGES, TO IDENTIFY PROBLEMS AND OPPORTUNITIES, TO KNOW WHEN TO DISSEMINATE INFORMATION AND TO MAKE DECISIONS
- CLASSES OF INFORMATION: INTERNAL OPERATIONS, EXTERNAL EVENTS, ANALYSES, IDEAS & TRENDS, PRESSURES

The disseminator outputs information to his organization. Henry distinguishes factual and value information: the former is usually simply transmitted, the latter is integrated, or at least treated, before it is disseminated.

The delegation dilemma: one aspect of assignment choice is who is best informed. Consider the time consumed in passing verbal information.

DISSEMINATOR

- FACTUAL INFORMATION - TRANSMITTED
- VALUE INFORMATION - INTEGRATED OR TREATED BEFORE TRANSMISSION
- DELEGATION DILEMMA: WHO IS BEST INFORMED

The spokesman outputs information to his organization's environment. Two groups need to be informed--key influencers and the organization's public. Public: customer, client, consumer, prospect, agency, supplier, etc. Expert information: CIT's position is...; AIS is working toward...; At Stanford we believe....

SPOKESPERSON

- TRANSMITS TO ORGANIZATION'S ENVIRONMENT: KEY INFLUENCERS AND ORGANIZATION'S PUBLIC
- NEEDS UP-TO-THE-MINUTE KNOWLEDGE
- ACTS AS EXPERT IN ACTIVITIES IN WHICH HIS ORGANIZATION ENGAGES

We reach the last of the major categories of roles, the decisional.

The four decisional roles mainly involve ... "Strategy making ... the process by which significant organizational decisions are made and interrelated."

Types of decisions range from voluntary and innovative to involuntary reactive.

Henry cites Herbert Simon's three-phase division of the decision process: intelligence phase, design phase and choice phase. (These are basic guidelines for a consulting engagement.)

DECISIONAL ROLES

- ENTREPRENEUR
- DISTURBANCE HANDLER
- RESOURCE ALLOCATOR
- NEGOTIATOR

"...initiator and designer of much of the controlled change in his organization." Intelligence phase is fed by monitor role. Manager may involve himself on any of three general levels in the design and choice phases of an "improvement project": delegation, authorization, supervision.

ENTREPRENEUR

- VOLUNTARY ACTIVITIES
- INITIATOR AND DESIGNER OF CONTROLLED CHANGE
- DECISION PROCESS PHASES - INTELLIGENCE, DESIGN AND CHOICE
- DELEGATION, AUTHORIZATION, SUPERVISION

Entrepreneur, above, deals with voluntary action. Disturbance handler role deals with change in involuntary situations.

Disturbances occur when an unusual event isn't met by the normal operations of an organization, or when normal operations break down. The manager is also the generalist who must solve all problems with which his organization can not cope; sometimes he gets help from other experts--police, internal audit, the Help Center, legal, personnel, purchasing, etc.

Three major types of disturbance are postulated: (1) conflicts between subordinates over resources, turf or personalities; (2) exposure difficulties between organizations; and (3) resource losses. Timing is important in resolution. Routine information seldom identifies disturbance. Disturbance takes priority; quick fix now, repairs later. [READ, and compare, Drucker, p. 48, and Sayles, p. 85.]

DISTURBANCE HANDLER

- INVOLUNTARY ACTITITIES
- NORMAL OPERATIONS BREAK DOWN OR DON'T FIT THE SITUATION
- GENERALIST ACTIVITY
- PRIORITY ACTIVITY

Strategy is constrained by resources: "money, time, material and equipment, manpower, and reputation."

Resource allocation has three main elements: (1) scheduling time (his own, which governs implicit and explicit priorities); (2) programming work (what, by whom): and (3) authorizing actions (in the framework of a 'budget' or the framework of a 'model').

RESOURCE ALLOCATOR

- MONEY, TIME, MATERIAL & SUPPLIES, EQUIPMENT, PERSONPOWER, REPUTATION
- SCHEDULING TIME, PROGRAMMING WORK, AUTHORIZING ACTIONS
- BUDGET VS MODEL/PLANS

For major and non-routine negotiations with other organizations or individuals. Why does everyone want the manager here? Because the resource allocator can commit, the spokesman can represent and the figurehead is usually required.

NEGOTIATOR

- NON-ROUTINE NEGOTIATIONS
- WHEN THE CHIPS ARE DOWN
- FIGUREHEAD, SPOKESPERSON & RESOURCE ALLOCATOR

*****
We've covered the main elements of what Henry believes are the common ground of managerial work:
6 distinguishing characteristics and 10 roles.

*****
Only time will tell if I've accomplished my first objective, getting you to read Henry's book.

I hope that something of Henry's that I've retailed to you has struck a chord and that I've partially met my second objective, giving you an additional context in which to view managerial work.

The third objective remains. It has to do with our shared, I think, difficulties in providing information systems which directly support managers. Not their department's work, but their own work.

*****
I'd like your help in these last few minutes. Let's go thru the roles and see what suggestions you have for supporting them with information system services.

FIGUREHEAD
LIAISON
LEADER

MONITOR
DISSEMINATOR
SPOKESPERSON

ENTREPRENEUR
DISTURBANCE HANDLER
RESOURCE ALLOCATOR
NEGOTIATOR

IF THESE ROLES DEFINE WHAT MANAGERS DO,
HOW CAN INFORMATION SYSTEMS HELP?

*****
Thank you for sharing you time with me, for your kind attention and for your help.

DESIGNING AN INFORMATION SYSTEM: THE SOCIO-TECHNICAL APPROACH

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ABSTRACT

Our technical abilities to design and build sophisticated Computer-based Information Systems (CIS), have progressed rapidly. However, our ability to make these systems part of the living fabric of organizational systems has not kept pace. Some CIS are never installed, while installed systems sometimes fail completely and usually run into problems.

These implementation problems can be solved substantially by embedding CIS design within the Socio-Technical Systems (STS) design approach. Since the target of change for the STS designer is an organizational system, this embedding guarantees that the information system portion is co-designed with other organizational parts insuring maximum integration and performance. This paper discusses one of the key principles utilized by the STS approach to insure successful STS/CIS implementation.

INTRODUCTION

No one ever sees an organization. An organization is the maps or images we carry around in our heads. As human beings we live in a "real world". We do not, however, operate directly on the world. Each of us conceptualizes the world in which we live--that is, we create a map or frame of reference which we use to guide our behavior. Our map of the world determines to a large degree what our experience of the world will be, how we will perceive the world, what choices we will see available to us in the world. Organizations and the processes and jobs within them are,therefore, inventions which are under constant modification; they are man-made and are based on the existing maps of those that design, manage and work in them.

The major reason Computer-based Information Systems (CIS) have had so many failures and implementation problems is the way CIS designers view organizations, their members, and the function of a CIS within them, i.e., the maps they use to design/change organizations.[1] These views are embedded in a design methodology or approach which guides the development and implementation of a CIS. The intent of this paper is to introduce the reader to a design approach known as Socio-Technical System (STS) design which is based on a more realistic view of organizations. STS is fairly recent development in the quest for organizational systems which are both more satisfying to their members and more effective in meeting task requirements. The STS approach has evolved from efforts to change actual organizations, not from theories developed in academic ivory towers.

CIS failures and implementation problems can be substantially solved by embedding CIS design within the STS design fromework.[2] The purpose of a CIS intervention is to improve the functioning of an organizational work system (e.gs. Accounting, Payroll, Registrar, Bursar, etc.). My argument is simply that by embedding the traditional CIS maps and methodology within the STS framework, a more effective design approach is created, improving the chances of a successful implementation. The STS approach is not necessarily better than any other approaches, but it is more useful because it demands a broader perspective. STS design, in addition to its own unique emphasis on system learning and flexibility, becomes a vehicle for the most effective application of design techniques embodied in other methodologies such as CIS, job or engineering design.

STS maps can be depicted in a basic set of principles and assumptions. An STS design methodology is comprised of techniques and procedures based on these assumptions and principles. The purpose of this paper is to illustrate how STS principles and assumptions (and techniques based on them) can be utilized to effectively implement a CIS. Although the techniques are important and useful, the focus will be on the principles and assumptions. There are usually many different techniques a designer could employ to implement a principle. CIS designers often get too absorbed in techniques, losing sight of the principle they are implementing. For example, research indicates the biggest single benefit of the new structured design techniques appears to be the improvement of user and designer communication via the development of a shared logical information processing model of the work system [4]. The key is, therefore, the development of shared logical models (i.e. principle), not whether this development is done using Data Flow Diagrams, SADT or some other technique. Yet most of the CIS literature focuses on the design techniques not the principle they are trying to implement.

As a CIS designer, you may never use a full-blown STS methodology, a complete set of STS techniques. However, you can still become a better designer by integrating STS principles into your work, i.e., untilizing certain STS techniques and/or developing your own principle-based techniques. Due to space limitations, this paper will discuss one key STS principle. More details on this and other principles can be found in Bostrom [3]. For those looking for a complete STS/CIS methodology, including the description of useful techniques, I would strongly recommend articles by Bostrom and Heinen [2], Taylor [10] and Mumford [7] and the book by Mumford and Weir [8]. The latter book provides the best overall mechanism for introducing someone to a STS/CIS approach. It contains a conceptual overview combined with experiential case exercises which provides the reader with a complete learning package. Bostrom [3] provides more detailed references for those interested in pursuing this topic.

PRINCIPLE: VIEW WORK SYSTEM AS AN OPEN SOCIO-TECHNICAL SYSTEM

To change an organization, a designer must have some picture of the target of change. The adapting and changing nature of organizations causes the STS designer to view them as open systems. Systems having permeable boundaries through which constant interaction between system and environment takes place, i.e., system inputs and outputs. The notion of bounding a system makes explicit the target of change. CIS designers often neglect to establish clearly defined boundaries, i.e., what am I changing? It is very difficult to change a moving target. These boundaries, however, are not fixed, and further analysis may cause the designer to expand or contract them. Types of boundaries vary depending upon the design task. A boundary could be organizational, (e.g. accounting department), task (e.g. CIS maintenance), or territorial (e.g. loading dock).

Once the boundary is set, the designer must adopt a system map. System maps usually describe a system as a set of interrelating parts. The STS designer views an organizational work system (e.g. Accounting department) as a socio-technical system. As indicated in Figures 1, a work system is made up of two jointly interacting systems--the social and the technical. The technical system is concerned with the processes, tasks and technology needed to transform inputs to outputs. The social system is concerned with such things as the attributes of people (e.gs. attitudes, skills and values), the roles they enact, reward systems and authority structures. The outputs of the work system are the result of joint interactions between these two systems. Any design or redesign of a work system must deal with these two systems in an integrated fashion.

The traditional CIS perspective of work systems is quite different from the STS view. The primary targets of change are task (decision-making, data collection, data manipulation and data transmission tasks) and technology (use computer-related) variables. This limited focus leads the CIS designer to ignore the fact that these changes cause more changes within other variables in the work system. Changes in the work relationships and people variables are as important as the changes in the task and technology variables. The important point, the STS designer would argue, is that all of these types of changes should be designed to complement and reinforce each other. The STS design methodology provides mechanisms to insure this happens.

The STS design methodology provides the designer with a set of tools for analyzing the social and technical systems and the environment. The relationship between the social and technical systems can be described in terms of design mechanisms which integrate the variables in the two systems. For example, the task variable set is correlated to the people variable set (see Figure 1). The design mechanism by which these relationships are actualized is job design--the allocation of tasks to jobs which people perform. The design of the information processing system is the second of six major design mechanisms within the STS framework.[3] The STS designer's targets of change (i.e. parts of a work system) are, therefore, the two interacting systems (social, technical) the variables within each system (tasks, technology, people, roles/structure), and the design mechanisms (job, information processing, etc.) which integrate the variables in the two systems. While the CIS designer focuses on the information processing design mechanism from a technical system perspective, the STS designer clearly takes a more wholistic perspective.

As Figure 2 illustrates, the STS design process starts with separate analyses of social and technical systems resulting in shared understandable maps of both systems.[4] The procedures for developing technical system maps are highly structured (sometimes referred to as variance analysis) while those for the social system are very flexible and thus tend to vary greatly between practitioners. All social system techniques include an analysis of users' Quality of Working Life or Job Satisfaction (Mumford and Weir [8] provide a good approach). If additional social system analysis is done, it tends to follow a structural (i.e. focus on design mechanisms) or functional (i.e. focus on functions of social system: goal attainment, adaption, integration and long term development). The structural and functional approaches are illustrated in Bostrom and Heinen [2] and Taylor, et.al. [11] respectively.

The shared maps are used to generate and investigate new alternative designs for technical and social systems, then both sets are integrated into a new set of choices that consider the demands of both systems (socio-technical choices - see Figure 2). For example, job design (grouping of tasks) can be looked at strictly from a technical perspective, i.e. technical alternatives. Similarly it can be looked at from the demands of the social system (e.g. people growth needs, system flexibility/adaptability), i.e. social system choices. STS argues both views must be considered and integrated into socio-technical choices.

The new socio-technical design is chosen in such a way that the social and technical systems are jointly optimized. (See Figure 2.) The goal of joint optimization implies that the best design alternatives in technical system and their effects on having the best in the social system are jointly considered. Technical system optimization is usually measured in the improvement of Task Accomplishment (TA) while social system optimization is measured in the gains of the Quality of Working Life (QWL) of the work system's members. Task accomplishment is concerned with the efficiency with which inputs are mapped to outputs. TA from a system level perspective is concerned with such things as improvement in productivity (quantity) and/or quality of the product or service and cost reductions. QWL is concerned with the degree to which employees within the work system are able to satisfy personal needs, i.e., meaningful and satisfying work, recognition, control and influence, learning opportunities, good wages and working conditions, etc. The joint optimization principle can, therefore, be expressed in terms of maximizing the improvement in both TA and QWL whenever a work system is changed.[5] From a QWL perspective, the designer is trying to find the best fit between members' needs and the roles/jobs available.

Each design mechanism in the STS framework represents a set of socio-technical choices, e.g. boring tasks need not produce boring jobs. The output of an STS analysis provides the information to decide which choices are best for a particular work system. The global design of any changes to the CIS are produced from this analysis, and is based on the total needs of the work or business system. Once the global CIS design is clear, the traditional CIS design process takes place to design and develop the new CIS. The primary difference between STS/CIS and CIS approaches is, therefore, the fact that the STS analysis provides major information requirements and goals to guide CIS development based on a detailed analysis of total work system needs. The traditional CIS approach starting point is the development of goals and requirements as they relate to information processing needs (not total system) and this information is usually developed by asking a few key users what they want, not through a systematic analysis. Also, in the STS/CIS apporach, the other parts (e.g. jobs) of the STS are being designed in parallel. Since all lower level design takes place within the STS framework, the different types of changes implemented will complement and reinforce each other (see Figure 2).

CONCLUSION

If CIS designers want to improve their probability of a successful implementation, they must integrate CIS design within an STS methodology, i.e. take STS/CIS approach. This paper outlined one principle (viewing work system as an open STS) in depth and briefly introduced two others (the development of shared work system maps and the principle of joint optimization), all three illustrate the benefits of this integration. The STS view of a work system provides a wholistic map in which the traditional information processing view of the CIS designer is merely one design mechanism. Design approaches, besides CIS, can be easily integrated into an STS methodology to insure systematic change takes place within the work system. For example, the job design orientation of the job enrichment expert merely emphasizes another design mechanism in STS map. An STS designer may choose not to deal with all system parts, e.g. design mechanisms, but he/she will always be aware of parts and their interrelationships. CIS designers must develop this awareness to insure maximum integration and performance between the information system portion and other organizational system parts.

FOOTNOTES

[1] Implementation for an STS designer begins on day one. The term "implementation", therefore, refers to the entire design cycle: analysis, design, development and installation. The term "CIS designers" is being used to include all people who actually influence CIS design decisions, i.e., system analysts, users, programmers, etc.

[2] Since the target of change for the STS designer is an organizational system, the STS approach is also applicable to the design and management of the Information System Department. Most of the problems facing an IS department can be effectively attacked with the STS approach.

[3] The other four are Organization Design (role relationships), Direction (decision and policy making, etc.) Reward System, and Personnel System (selection, training, etc.). For more detailed discussion of all aspects of the STS view of a work system, see 1, 5, 6 and 9.

[4] The development of shared (shared between users and designers) work system maps is critical to any change effort. The global STS maps are exploded into more detailed maps of design mechanisms (see Figure 2). For example, structured design techniques can be used to develop detail shared maps of current and desired information processing systems. The principle of developing shared STS/CIS maps is discussed in Bostrom [3]; using structured design techniques to develop CIS detailed maps is discussed in Bostrom and Nault [4].

[5] The principle of joint optimization is discussed in more detail in 1, 3, 5, 8 and 9. CIS designers focus on technical system optimization, neglecting QWL issues. Research has clearly demonstrated this to be a suboptimal strategy [3].

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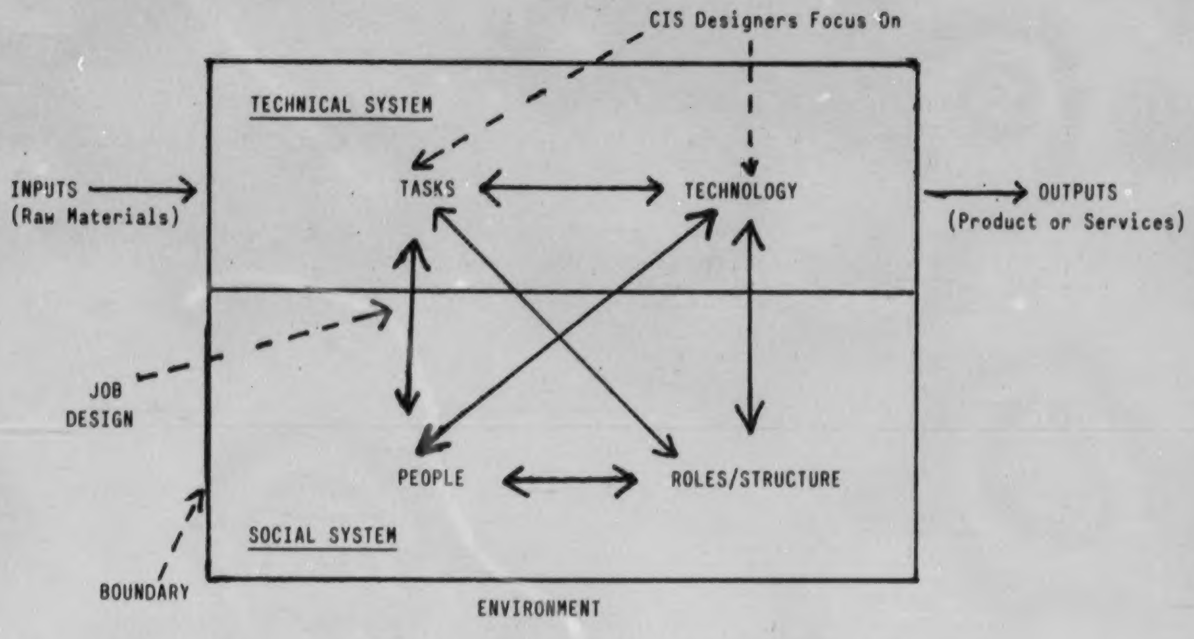
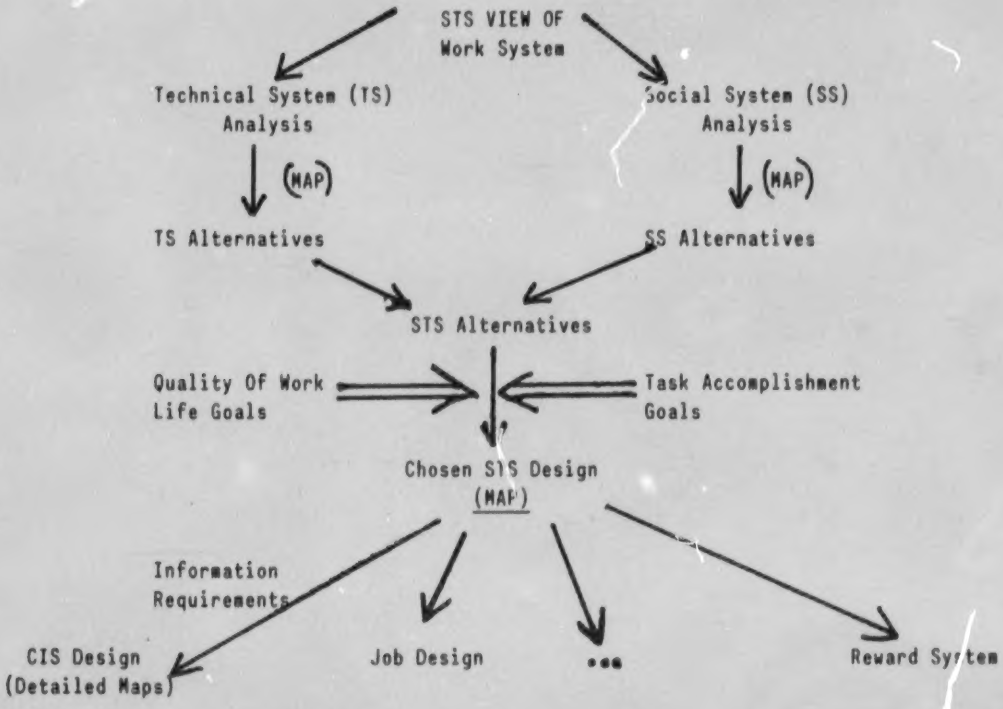

CIS Designers Focus On
TECHNICAL SYSTEM
INPUTS
(Raw Materials)
TASKS
TECHNOLOGY
OUTPUTS
(Product or Services)
JOB
DESIGN
PEOPLE
ROLES/STRUCTURE
SOCIAL SYSTEM
BOUNDARY
ENVIRONMENT

FIGURE 1: An organizational Work System
Viewed as an Open Socio-Technical System

FIGURE 2: STS DESIGN PROCESS
(The Shared Map-Making Process)


STS VIEW OF
Work System
Technical System (TS)
Analysis
Social System (SS)
Analysis
(MAP)
(MAP)
TS Alternatives
SS Alternatives
STS Alternatives
Quality Of Work
Life Goals
Task Accomplishment
Goals
Chosen STS Design
(MAP)
Information
Requirements
CIS Design
(Detailed Maps)
Job Design
•••
Reward System

CHARACTERISTICS OF AN MIS EXECUTIVE WITHIN HIGHER EDUCATION

by

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Introduction

Increasingly institutions of higher education are finding themselves under pressure to supply more and better information for scrutiny by the general public and parsimonious-minded legislatures. This increasing demand for data can be attributed to a combination of factors: an increase in the number of reporting relationships, expanding external information requests, and a generally increasing number of students and employees for whom more information is desired (Lawrence and Service, 1977, p. 29).

Along with this growing concern for public accountability there has been a much-improved cost/benefit relationship brought about by the declining cost of computer hardware and by easier-to-use computer languages and software. As a result, many institutions are turning (some perforce, some more willingly) to Management Information Systems (MIS) which integrate the institution's operational, managerial, and executive level information into a basic data/information/decision-making spectrum.

Development of an MIS has tremendous potential for increasing the efficiency, timeliness, and success in the decision-making process. But the problem today is that many MIS efforts appear to be failures. Soden, in an article on MIS failures, points out that "...abandonment of multimillion dollar efforts is a relatively commonplace occurrence today and that other MIS efforts are completed but have limited utility and far exceed their cost/benefit ratio where projected costs may have tripled before completion of the project" (Soden, 1975, p.29).

Whereas Soden was speaking mostly of the business world, similar actions are observed in the realm of higher education where, according to Gardner and Parker (1978, p. 10), few (if any) MIS installations have been successful within any institution of higher education.

It is the purpose of this paper to examine only one factor that appears to contribute to an MIS failure--the MIS executive-in-charge. Beginning with a brief overview of historical thought on effective management, and followed by a comparison of executive styles, the paper concludes with some summary observations on what personal qualities/characteristics might contribute to the success of an MIS executive within higher education.

Historical Perspective

In reviewing the literature of managerial studies there are, roughly speaking, three periods in the development of administrative thought: concern for production (1910-1930); concern for people (1930-1950); and the interrelationship between production and people as a behavioral science (1950 to the present).

The first approach is characterized by Frederick Taylor, often called "the father of the scientific management," and Henri Fayol. Both Taylor and Fayol were concerned with industry; both believed that the processes involved in production could be analyzed and studied scientifically. Although Taylor concentrated on the worker and Fayol the manager, both had as an ultimate objective the increased efficiency of industry. In his later years Fayol extended the application of his administrative principles to government as well as industry. Whereas both men stressed organization processes and tended to ignore individuals as such, both felt that the success or failure of an enterprise was due to the traits or characteristics of the manager-entrepreneur-leader (Wren, 1979).

Human relations constituted the second major approach to administration. Two major contributors to the movement are noted: Mary Parker Follett and Elton Mayo.

Follett contended that the fundamental problem of any enterprise, whether it be governmental, educational, or business, was the building and maintaining of dynamic, yet harmonious, human relationships. Further, in the "work of society and industry," human relationships are at their best when difference is solved through conference, cooperation and coordination (Metcalf and Urwick, 1942, p. 14).

Mayo emphasized the dependence of productivity on small-group unity. Although his pioneering research effort at the Western Electric Company's Hawthorne Works in Chicago is subject to various interpretations, Mayo's findings clearly indicated that economic and mechanistic approaches to management were inadequate. While wages and working conditions are important to the worker, they rank second to what Mayo called "a method of living in a social relationship" (Mayo, 1946, p. 73, 75).

A third approach is characterized by the interrelationship of both the behavioral science and the administrative approaches.

Chester Barnard appears to have been the first to relate administration to the behavioral sciences. One of Barnard's major contributions was the concept of effectiveness and efficiency. In his book, The Functions of the Executive, he states (Barnard, p. 14, 1938):

> Effectiveness is system oriented and has to do with the achievement of organizational goals. Efficiency, on the other hand, is person-oriented and has to do with the feeling of satisfaction a worker derives from membership in an organization.

For the first time, the interrelationship of organizational achievement and individual satisfaction was noted. This conception did much to put the work of Taylor and Fayol, who had concentrated on organizational achievement, and Follett and Mayo, who had tended to emphasize individual satisfaction, in appropriate perspective. Whereas the first approach emphasized management and production and the second approach emphasized interpersonal skills and human relations, the third approach emphasized the interrelationship of both the behavioral science and administrative approaches.

The MIS Executive Style

Much (if not most) of the literature today regarding MIS executives is heavily business-oriented. As such, certain caution should be used in trying to apply the managerial techniques of business to higher education. Gardner and Parker (1978, p. 10) thought that because institutions are "administered" and not "managed," that the decision-making process becomes more political than managerial. In a similar manner, Drucker (1974, p. 335) states that it is in the nature of the organization whether or not administration or management is the most appropriate type of leadership. Within higher education, informed academic judgment rather than numerical methodology methods is used more often than not by administrators (Bowen and Glenny, 1976, p. 27). And finally, as Nevins points out (1962, p. 87), outside political pressure rather than inside planning has far more to do with how administrators in higher education make decisions and operate in general.

With these caveats in mind, a characterization of successful MIS executives in higher education will be attempted utilizing Blake and Mouton's managerial grid (Blake and Mouton, 1964) and Soden's stereotypes of MIS executives. It should be remembered that these exercises were developed within a business environment. Bloom (1980) reviewed Soden's characteristics of an MIS executive, however, his interpretations differ from those expressed in this paper in relationship to higher education.

Soden writes strictly from a business/managerial viewpoint; he states clearly that the "MIS architect" (the individual-in-charge) is the "prime determinant" of success or failure (1975, p. 32).

He classifies the MIS architects into five stereotypes based on three tasks--controlling, planning, and organizing. For reasons that are not entirely explained, he does not consider the tasks of communicating, motivating, problemsolving and persuading--all prerequisites to effective administration (Walker, 1979, pp. 4-8).

In reviewing Soden's classifications from the business environment, an attempt will be made to liken them to possible counterparts in higher education. In so doing, the reader is asked to imagine that a committee has been established at a large institution, known as MIS Guided University (MGU), to oversee the development of an MIS. This committee is composed of the following individuals: the recently-hired Director of Institutional Research; a tenured professor; the Chairperson of the Quantitative Methods Department; the Vice President for Business Affairs; and an outside consultant. Each of these individuals will serve as head of the committee.

Soden's flamboyant conceptualizer is a creative, perceptive, persuasive, "blue sky" type manager. He/she is oriented toward top management's inner circles and because of his or her persuasiveness can obtain "mammoth commitments" of resources (Soden, 1975, p. 37). He or she attracts young, inexperienced, but highly motivated professionals. However, his or her inattentiveness to the day-to-day operations and lack of desire to oversee the detail work eventually lead to his or her losing control of the project. By the time top management realizes that it has far exceeded the cost/benefit ratio originally projected, the flamboyant conceptualizer (FC) has already moved on.

In our scenario at MGU, the new Director of Institutional Research is the flamboyant conceptualizer's counterpart. Similar to the FC, he is well-informed and attuned to what is happening at the institution. Also, he has the ear of top management and is able to persuade the administration that an MIS will solve all their problems. Further, he argues that top administration will no longer have to use educated guesses whose roots are in magic pencils and Kentucky windage. Instead, they will have detailed custom reports on which to base their decisions. Two years and two million dollars later, the faculty is irate over the infringement upon their academic freedom, the president has been fired, the project has been abandoned, and the new director has been promoted.

Soden's second type of MIS executive is the benign underachiever. Typically he or she has been around for a long time and knows how not to make waves. He or she is a survivor who takes no risks and because of this makes few mistakes. Also, his or her lack of any established performance measures allows him to cover up his or her failures.

At MGU this could represent the old establishment, or a faculty that is set in its ways and extremely resistant to change of any sort. In this setting, a tenured professor--needing something to do until retirement--has been put in charge of the project. Like the benign underachiever, he has a great deal of responsibility now, but little real power to control the situation. In charge of the project, he tends to ignore many of the directives from the top and to plod along in an established pattern designed not to offend anyone or raise any hopes. Eventually the project will die of lack of inertia and commitment (memoed to death) *just as he* (the old prof) *said it would*.

The *tyrant* is characterized by Soden as having a very poor understanding of the entire situation and having only budgetary control over the project. As such, he or she runs the department with an iron hand, being exceedingly tough on noncritical issues--such as punctual attendance at meetings or using wooden pencils instead of BICs--and rather non-committal on matters of some real substance. Within higher education this type of administrator now seems to be observed much more frequently, especially in these times of severe financial hardships and declining enrollments. Conditioned to bare-bones budgets, he or she thinks of very little other than current expense. At MGU he is represented by a department chairperson, and his leadership on the MIS committee would at best be ineffectual; however, no harm would be done. This is not necessarily true with Soden's next stereotype--the *efficiency expert*.

The efficiency expert in business completes an MIS project on time and usually within the budget. Unlike the benign underachiever, the efficiency expert has considerable power and excellent organizing abilities to manage his or her responsibilities. The only drawback is that because very little imagination has been used in designing the system for the future, it will probably end up more operationally-oriented than tactically-oriented, thus making it less useful for the organization, with relative inflexibility leading to costly retrofits (Soden, 1975, p. 30). The Vice President for Business Affairs at MGU would seem a logical choice to fit this description. As a stereotyped efficiency expert, he would have great difficulty understanding and accepting the "authentic tradition of amateurism" (Brown and Luedke, 1978, p. 75) which accompanies some university administrators who come up from the academic disciplines and who will soon return--after a brief stint of administrative service. Universities are many things to many people--but efficiency is not one of their strong suits, as collegiality and committees do not encourage it.

The final MIS type is the fast-tracker. According to Soden this is the one MIS executive who combines all the best traits of the efficiency expert and the flamboyant conceptualizer. Within business and industry this is the ideal person for an administrator. Within higher education, however, this combination is less likely to work. The efficiency expert could not accept the fact that most major change is effected from outside the institution and that his/her control over political matters is almost non-existent.

The truly effective MIS administrator in higher education would benefit from a combination of characteristics of all five of Soden's types, plus some other qualities.

At MGU there is no one person who fits into the category of fast tracker, so a consultant has been brought in. This consultant has been hired because he/she has the vision and charm and drive of the flamboyant conceptualizer. This, however, is tempered with the knowledge of the reality of the people and the system --all too well known by the benevolent underachiever--and a knowledge as well of the budget constraints he/she must live with, and the possibility of not having funds appropriated again (characteristic of the tyrant). Lastly, he has the organizing ability of the efficiency expert and the necessary clout to ensure cooperation among his peers.

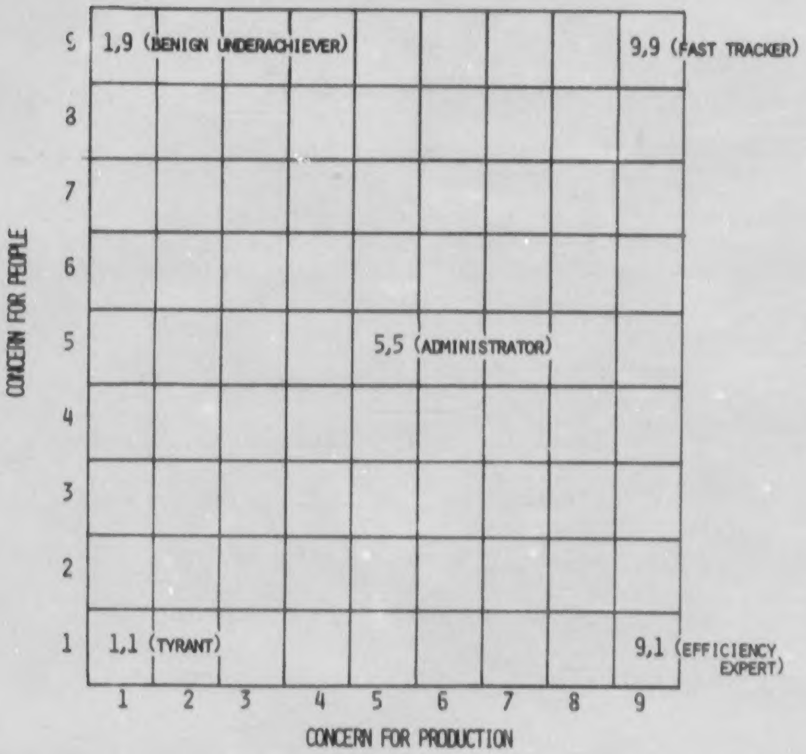
Some other desirable qualities would include the ability to "diplomatically persuade" and to work as a problem-solver with groups of individuals who are resistant to change and who will expend incredible amounts of energy resisting decisions viewed as alien. This resistance should not be viewed as wrong--in fact, it may be very good--it possibly shows interest; or at least that the faculty is not smugly complacent or completely apathetic about an MIS failure. An MIS may be implemented, but it can also be ignored.

In a further attempt to conceptualize these blends of leadership styles, a "grid approach" has been attempted utilizing the efforts of Blake and Mouton (Figure 1) and overlaying Soden's stereotypes based on possible leadership styles concerning people and production in a managerial mode.

The grid alternatives reflect two dimensions: "concern for people" on the vertical axis, and "concern for production" on the horizontal axis, with each axis having a nine-point scale, and with the number 1 representing minimum concern and the number 9 indicating maximum concern. Although a variety of different possibilites could be shown, Blake and Mouton emphasize those only at the four corners and in the middle. Each of these five positions depicts a definite, but different, set of assumptions regarding how managers orient themselves for managing situations of production that involve people.

Figure 1

MANAGERIAL GRID/ BLAKE AND MOUTON


1,9 (BENIGN UNDERACHIEVER)
9,9 (FAST TRACKER)
5,5 (ADMINISTRATOR)
1,1 (TYRANT)
9,1 (EFFICIENCY EXPERT)
CONCERN FOR PEOPLE
CONCERN FOR PRODUCTION
1
2
3
4
5
6
7
8
9

In the 9,1 style, heavy emphasis was placed on task and job requirements, with the manager occupying a position of authority and being responsible for his or her subordinates so that production objectives could be reached. This would correspond with Soden's efficiency expert, who also has a position of authority and is highly production-oriented, but has little regard for people except as they affect morale. The 1,9 style emphasized satisfying the needs of people in a way similar to Soden's benign underachiever--by not rocking the boat and thus risking offending someone. The 1,1 approach would best be typified by Soden's tyrant who shows little concern for people or production, but is much more concerned with how the budget is spent and whether he survives.

Whereas Blake and Mouton classify the 5,5 approach as a managerial style ("country club executive") with many drawbacks, the authors feel that this style more often typifies administrative functions rather than managerial. This style also recognizes the responsibility of the person in charge to plan, direct, and control. But the 5,5 manager leads, motivates, and communicates--rather than commands--to get the work done.

The 9,9 approach typifies the "fast-tracker" of Soden, the person with the ability to resolve the inherent conflict between organizational purpose, production goals, and the needs of people. Because people understand and have a real stake in the outcome, this approach creates optimal work conditions, so that there is little or no necessity for direction and control in an authority-obedience sense. The 9,9 assumes that there is a real and viable product being produced and that success or failure can be measured by the quality of that product and the satisfaction of the production team and the end-users. In higher education this may not always be the case. If, as Toffler (1970, p. 334) states; "the school is the factory, and the faculty are the workers, and the students are the raw material...," then what is the product? If the final product is the finished student, is this quantity or quality measureable or controllable?

In summary, the effective MIS executive in higher education is probably more administrator than manager, thus more people-centered than job-centered. Table 1 compares some of the administrative traits found in the effective MIS executive within higher education to an MIS manager in business.

Table 1

Characteristics of MIS Leaders/Architects

BUSINESS/INDUSTRY MIS MANAGER	HIGHER EDUCATION MIS ADMINISTRATOR
1) Spends a lot of time doing "the same things" that the employee does.	1) Takes more of a leadership role. Spends more time planning and supervising.
2) Makes detailed assignments.	2) Allows employees freedom to do their jobs their own way.
3) Tight supervision.	3) Relies on team building efforts.
4) Compartmentalizes employee tasks.	4) Involves employees and encourages understanding of the entire project.
5) Tells employees that they are "not paid to think."	5) Encourages suggestions.
6) Goal oriented/profit motive.	6) Issue oriented/social synergism.
7) Isn't concerned with employees' outside interests, families, or problems.	7) Very good at interpersonal skills and is a good team person and morale builder.
8) Apolitical.	8) Understands the power structure and recognizes political interest groups. A very effective political diplomat.

The development of an MIS within an educational environment can be perceived as a threat by many entities. The astute MIS administrator must be fully aware that any attempt to centralize basic data is likely to be of great concern to individuals and groups in a political arena. Some political power is innerent in the ability to interpret and manipulate data and the information on which decisions are based. When the information for such systems provide the justification for political decisions, the MIS and its administrator are likely targets for attack from displaced political entities. These entities are first to judge an MIS administrator as a failure.

In the political atmosphere of higher education, an effective MIS administrator must maintain constant effort to build the trust and confidence of all the entities he or she serves. Open-endedness and honesty with all entities is necessary to promote the kind of understanding that will support and undergird an MIS effort. Especially, it is important for lower echelon administrators to know how and for what purposes information about the entity for which they are responsible will be used. Feedback of this nature is invaluable in cultivating the kind of trust and cooperation needed for a successful MIS.

The effective MIS manager tries to breed an atmosphere of trust through open-endedness and honesty as well as through his or her experience and understanding and intuitive feel for the politics involved. If he or she is succeessful, synergy will pervade the institution, and the MIS will have a chance to grow and become useful. If not, parochialism and mistrust will prevail and the MIS is either resisted, sabotaged, ignored, or abandoned. Only when the personal characteristics of an MIS administrator support and enhance an atmosphere of trust and cooperation between all levels of administration is there any likelihood that the MIS effort will ever be termed successful.

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Recruitment of Computer Services Personnel for Colleges and Universities

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Far too many administrators, confronted with the discouragement of recruiting qualified computer services personnel, succumb to despair. This paper takes a more optimistic view that competent data processing talent can be attracted to work within higher education. The shortage of computer programmers and analysts is a nation-wide problem, common to all organizations, even those toward which colleges cast envious glances. Meeting that challenge calls for a continuous and consistent recruitment procedure.

Recruitment is composed of contact, interview, and closing. Tips for each of these phases of recruitment are given, although the central message is that no bag of tricks is going to solve the problem of difficult recruitment of data processing personnel. Rather, successful recruitment is a result of vigor, optimism, and follow-through on the part of the recruiter.

Herb Halbrecht, at last year's National CAUSE Conference, challenged higher education administrators by noting that he did not believe that colleges and universities could recruit the top 10-15% of data processing capability for their own operations. Halbrecht meant for his remarks to be controversial; and he also meant for his remarks to goad educators on the subject of low salaries. Notwithstanding his agitation, some people think the recruitment situation may actually be quite a bit worse -- perhaps, they say, higher education can no longer recruit the top 90% of the personnel within the computing field. Certainly there is a great deal of discouragement about recruitment. Fortunately, this discouragement is based on circumstances less substantial than any inherent inferiority of employment within higher education administration. It is based, rather, on a lack of understanding of two basic facts about recruitment:

1) Recruitment is a key part of personnel management activity, which also includes selection, motivation, development, and retention of personnel. None of these activities gets the understanding or attention it ought to in most organizations.

Why are personnel activities given such short shrift? A partial reason is that many managers erroneously feel it is not in their responsibility, that somehow a staff Personnel Administration function is taking care of all those things. Another reason is that, in colleges and universities, those responsibilities are very poorly recognized, owing perhaps to the idealized collegial nature of the enterprise. And it is also true that computing services management everywhere is beset with such technical challenges that personnel management is forced into a lower status.

2) Recruitment takes a lot of effort. Not only does it take management attention, but it takes time. Good, careful recruiting of a key person may take six months or more.

Why is recruitment so difficult? First of all, there are always many qualified individuals who are satisfied with their current situations and who are uninterested in applying for any new position. Secondly, there truly is a shortage of computing professionals. One estimate is that the DP industry was more than 300,000 people short of its needs in 1981.[1] All installations, and not just those in higher education, are having to dig harder to get qualified individuals for their computing services areas.

This paper attempts to deal with the nature of successful personnel recruitment. Colleges and universities deserve and need the best information systems professionals. Recruitment has to be emphasized in order to attract the kind of individuals who will achieve the results in administrative systems that higher education needs.

How is Contact Established With the Prospective Employee?

The first step in successful recruitment is to establish an applicant pool. For some clerical and mechanical occupations in a typical Computer Services organization, a local advertisement will be adequate to gather sufficient candidates to make a good choice. However, for most professional positions, recruitment will have to be more extensive. A recent Fox-Morris Personnel Consultants survey[2] classified the following occupations as the "10 most-sought-after" job titles in computing organizations:

1) Applications Programmers
2) Systems/Software Programmers
3) Systems Analysts
4) Telecommunications Specialists
5) DP Auditors
6) Systems Managers
7) Data Base Managers
8) Software Engineers
9) MIS Directors
10) Entry-level Computer Science B.S. graduates.

For the remainder of this paper, titles in this list will be our major concern, since they give the organization the greatest challenge in filling open positions, and since they are a relatively homogeneous set of occupations falling within the quasi-professional and administrative activities of Computing Services organizations.

For these prospective employees, contact has to occur in creative and imaginative ways, using many different modes of information dissemination. A few typical ones are the following:

1) Present Employees. In a survey reported in Datamation[3], referrals from present employees or by word of mouth ranked as the most effective methods of recruiting.

When an installation's present employees are pleased, they will be ardent recruiters themselves, telling former colleagues and friends about opportunities when they are available. This contact mode is easy and inexpensive. If the installation's employees know that their employment suggestions carry weight, they will be as responsive as they would be with any viable suggestion program.

2) Local Advertisements. Of course, well-placed newspaper advertisements in the local media are an essential part of a successful contact campaign. Any advertisements, and especially local ones, must conform to the institution's Affirmative Action (or other) guidelines in regard to placement. Content should reflect the institution's image and should also reflect the needs of the position. However, there is no need to write an overly-staid advertisement. Hopefully, there should be some point of interest in the advertisement beyond a position announcement.

3) Regional Advertisements. Similar advertisements can be placed in newspapers with regional coverage. This mode is particularly apt when the regional paper's circulation area includes the local area of the institution.

4) Other Departments. Most institutions have some form of internal job posting which is used to internally publicize opportunities. Qualified personnel in one department usually find out about openings in another department, even by informal means. Assuming a healthy institutional environment which recognizes internal transfers as potential benefits, this contact mode can be a gold mine. It is probable that most industrial settings have exploited this means of entree into professional computing positions better than have educational institutions.

5) Business or Data Processing or Computer Science Departments. One unique aspect of higher education is that there is a body of "captive" applicants for administrative work who are currently students. Many students already have specific experience on the machine or system in question, they have generally-positive feelings about the institution, and they are there. Some institutions, recognizing this value, have a very close "supplying" relationship between the academic departments and the administrative ones. Such relationships can benefit all parties.

6) Local Contacts. Contacts are also possible through local professional organizations. Meetings of the Data Processing Management Association, the Association for Systems Management, or the Association for Computing

Machinery may be useful for getting the existence of your installation recognized locally. Be careful, however, because blatant recruitment at meetings is gauche and probably banned by the local group anyway.

7) National Advertisements. It is increasingly the case that, in order to contact experienced professionals, national advertisements in trade papers or professional magazines are necessary. It is certainly true that management positions have to be sought in a national market, but many other positions cannot garner a representative applicant pool without national advertising.

8) Open Houses. One innovative way of establishing contact is to hold an Open House, with people on-site to answer any questions about the institution or installation. Contacts made in an atmosphere of hospitality can be very valuable.

9) Re-contacts. Every time a position opens up, re-examination of unsuccessful candidates for the last similar vacancy should be made. Walter Stroman, a management consultant with Peat, Marwick, Mitchell & Co. suggests maintaining continuous contact and actively tracking the careers of those people who interview but are not hired.[4] Such a procedure, pursued constantly and vigorously, can yield results. As much as 20% of the staff in some organizations did not get hired for the first position they sought.

10) Agencies. Most educational entities are either forbidden or discouraged from working with private employment agencies. If not, that is a possible source of contacts. Occasionally, public employment agencies may serve as a source of applicants.

11) Walk-ins. A "walk-in" is someone who applies for a job without any external prompting. The person in question merely "walks in" to the Personnel office and asks for a job application. Since "walk-ins" are usually recognized as such only when there are no job openings, the hiring rate for this class of applicants is very low.

Other contact methods (for instance, trade or technical schools, user group meetings, job fairs, career days, and the ACM Computer Science Registry) may yield additional names. A minimum rule-of-thumb is that, for professional computing services positions, at least 20 names need to be secured for every open position; for some managerial positions, at least 100 names should be considered the minimum to get a true selection process. Most studies show that, the larger the applicant pool, the better is the subsequent selected candidate. As Erwin Stanton puts it: "...only candidates who apply can be considered for employment. People we have been unable to attract will never be viable contenders, no matter how desirable they may be. Their potential contribution to our company will never be realized. Therefore, as large an applicant pool as possible should be recruited."[5]

How Should the Prospective Employee's Interview be Used for Recruitment?

Since this paper's emphasis is on recruitment, interview technique will not be discussed except in that context. Interview technique is fertile ground for other topics of interest (technical content of interview, identity of interviewers, sociability or "friendliness" of interview, length and specificity of interview, etc.) but these will be left for another time.

First, the interviewer should screen suitable prospective applicants on the telephone. The telephone interview should be conducted so that the applicant is not inhibited by the occasion; for example, when possible, the applicant should initially be asked to state an appropriate time to receive an interview call. The telephone interview need not be extensive, but there should be sufficient time to determine if there is a lack of mutual interest. It may be necessary to ruthlessly prune applicants; an applicant who is diffident about an opportunity will not suddenly become enthusiastic once he has a personal interview. Also, pruning is needed to keep selection standards high by eliminating unqualified or marginally qualified candidates. Those people who survive the telephone interview should be invited for a personal interview. The personal interview is necessary for the serious applicant's interests; he or she can see things first-hand that the recruiter cannot explain at long-range. Hopefully, what is seen is positive.

The in-person interview should be structured. The same questions ought to be asked and the same discussions ought to be held with each applicant. If a test is to be given to a trainee, each person should take the same test with the same validation. If more than one person is to interview, the people and sequence ought to remain the same.

Although a major purpose of the interview is to secure information about qualifications, capabilities, and experience from the applicant, the atmosphere should be such that the applicant can determine answers to all of his/her questions about the job opportunity.

It should be clear by now that recruitment is, in large part, selling. The interviewer who is taking the role of recruiter must exploit the interview as a selling device. Advantages of the location, the organization, the installation, and the institution should be pointed out.

How is Closure Achieved With the Prospective Employee?

A salesman finds out early in his career that special efforts must be made to "close" a prospect. One of the most obvious sales techniques is that of "closing on a minor point." (Well, Mr. Jones, do you want the red model or the blue model?) Successful personnel recruitment also calls for successful "closing," but because we are dealing here with people's lives and careers, "closing" must be as straightforward as possible. No chicanery or deception can be used.

How a recruiter can end up convincing an applicant to become an employee is tied into the organization's motivational procedures once the applicant becomes an employee. An employer cannot lure someone into an employment situation which is inconsistent. For example, if the applicant is "sold" on the job on the basis of his or her ability to influence job content, if job content turns out to be narrowly defined and restrictive, the "selling" job has, in fact, set up a dissatisfaction. The selling job must, thus, take into account the organization's motivation and retention policies.

Frederick Herzberg, in his theories of motivation[6], notes that people are motivated by intrinsic satisfiers such as the work itself rather than by those factors which he labels "hygiene factors." Hygiene factors include such things as pay, status, interpersonal relationships, working conditions, job security, and company policies. Any recruitment closing argument should concentrate on those satisfiers that should already be a part of the work environment: achievement, recognition, responsibility, and advancement, in addition to the content of the work. Once the value of these has been established, other advantages of the college environment can be cited: generally good working conditions, the charm associated with higher education, institutional continuity, perhaps even psychic income. One of the badly underutilized selling points is that education is a profession with noble aims, with a humanistic view toward how computing can fulfill those aims. The recruiter should be able to favorably contrast work at a college with work at a beef packer's, for instance. In a recent laudatory article on Japanese management technique[7], the point is made that "pursuit of purpose" tends to bind people together in an enterprise. Konosuke Matsushita is quoted as saying "People need a way of linking their productive lives to society.... A business should quickly stand on its own based on the service it provides the society. Profits should not be a reflection of corporate greed, but a vote of confidence from society that what is offered by the firm is valued." Those of us in the field of education have even loftier antecedents; we ought to use them to assure recruits that they too can be a part of that tradition of social responsibility, intellectual growth, and scholarly achievement.

One important point: don't attempt to hire a person who is not correct for the job. But when the person is correct, closure should be sought as quickly as possible. Sometimes that may be possible at the time of the interview. More often, it is as soon thereafter as approvals have been secured and necessary paperwork has been completed. Studies show that, if an applicant has not received an offer within two weeks of the interview, he or she will assume that no offer is forthcoming. An offer within that period exploits the high expectations the interview should have engendered.

In brief, there should be nothing tricky about the final closing. The recruiter should state that the organization has a position for the individual with terms and conditions such as salary and starting date stated explicitly. A deadline for reply should be set, and that's it!

Conclusions

One of the reasons for asserting all these facts about recruitment is to de-mystify it. Anyone who needs people and who understands that need can recruit. It is not necessary to be a "professional recruiter." Given some experience with recruiting, managers of Computing Services organizations can recognize capability and charisma as well as executive search firms can, and that is their stock-in-trade.

Recruitment should receive continuous management emphasis. All hiring organizations need an unbroken flow of applicants to reduce the time of position vacancies and the time needed to activate recruitment sources. On the subject of management emphasis, a personnel consultant recently noted that "systems directors who devote less than a quarter of their time to personnel recruitment are probably unable to do their jobs effectively."[8] That is a much higher level of activity than most managers devote. And yet, there is no substitute for attention to personnel activity. People cause systems and activities to prosper.

The whole rationale behind recruiting assumes that there is a challenge (a position, a cause, a situation) which will interest people. A peddler finds it impossible to sell from an empty wagon; likewise, we should expect troubles trying to sell a poor situation to recruits. Also, if the situation is misrepresented -- or if there is no follow-up interest in personnel motivation and retention -- there is little merit in any flashy recruitment effort.

And then there is the matter of money. Money occupies enough interest in the recruitment process that it cannot be disregarded. A challenging position can go begging for applicants if the salary has been established too low. The successful recruiter is, quite frankly, going to have to be in a situation in which the compensation package offered is competitive. Participation in salary surveys, and the subsequent careful analysis of results, will help build a rational evaluation process to help determine the dollar size of offers and of existing salaries.

The successful recruiter for higher education needs to be competitive in other ways as well, including the cultivation of a positive attitude. Every installation, every location, and every institution has negative factors. Dwelling on these can ruin the salesmanship necessary for successful recruiting.

In conclusion, the successful recruiter

- establishes contact with as large and as representative a group of applicants as possible.
- screens the applicants, selecting the best for personal interviews

- establishes the personal interview in an atmosphere of information to be supplied to the applicant
- "sells" the situation by emphasizing the positive features of the situation
- retains and projects enthusiasm for the institution.

Administrative computing for higher education has many challenges facing it. One that can be met is the shortage of qualified people. It can be met with greater attention being paid to key personnel activities: consistency and vigor in personnel development, emphasis on personnel motivation, and optimism and perseverance in personnel recruitment.

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COMPUTER CENTER PERFORMANCE MEASUREMENT:
A CONCEPTUAL APPROACH

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The purpose of this paper is to discuss some of the conceptual issues behind the use of performance measurement criteria for administrative computing which is the basis for a proposed implementation at a large urban university. We accept up front that there is no "right" way to design such a measurement scheme. It must reflect the peculiar needs of an institution and the management style of its administrators.

Computer Center Performance Measurement: A Conceptual Approach

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Temple Overview

Temple University is a large urban university with over 30,000 students enrolled for credit and 1,000's more in continuing education programs, spread over several campuses from the main one in North Philadelphia to downtown, to the suburbs, including a medical center with a major hospital.

Computing functions from a central location which is facilities managed, a newly formed hospital center, multiple remote sites, 2 - 3 dozen minis in user shops and dozens of micros. Academic mainframes include a pair of CYBERS supporting over 200 terminals. Administrative work is done on an IBM processor with 10 billion bytes of disk storage, running under OS/VS1 using CICS. We are currently installing an administrative network of 150 terminals to run our new systems in an on line mode using the TOTAL data base manager and Easytrieve report writer. They include a full function payroll-personnel system and an integrated student information system including records, enrollment and registration, financial aid, student billing, accounts receivable and admissions. A facilities management firm operates the main unit and is doing development work on the two new major systems.

Computing Governance

The Office of Computing and Information Systems is the University entity responsible for planning and oversight of all data and word processing throughout the institution. It administers the facilities management contract, reviews all equipment acquisitions, oversees major systems developments and is generally responsible for executing University computing policy. The Director is a combination of auditor, advocate, coordinator, referee and ombudsman. In the present context, he brokers computing services while assisting the user community in formulating its goals. Both to execute the formal requirements of contract administration and to assure most effective use of limited resources, in the face of widely divergent competing demands, performance measurement is central. The present discussion focuses on administrative processing, but many of the same issues arise in the academic system.

Like many other large nonprofit institutions, the University is governed by a veritable alphabet soup of committees in a pseudodemocratic fashion. Nowhere is this more the case than with computing, which has generated an elaborate governance structure all its own. This arrangement tends to generate widespread participation with a minimum of responsibility on the part of anyone. Occasionally, outspoken individuals deviate from the rules, thereby causing confusion and generating progress. This has singular implications when one examines the institution of performance measurement.

Administrators are enchanted with the "magic" of computing, even while bemoaning late production runs and slow systems development. Their historical approach has been to throw computing, especially hardware, at problems to make them go away as if it were a panacaea. While they are quick to critize non performance by the center after the fact, they are less eager to define hard and fast standards for operations let alone developments, particularly if their own activities will implicitly be measured and affected by them.

Market View

Conceptually, we may view a University computing center as functioning like a firm in the marketplace, purveying needed services to its academic and administrative users from whom it extracts fees necessary to recover its operating expenses. In this view, the successful director is one who correctly assesses what his users want and plans so as to provide it at minimum cost. One might even envision a reward scheme tying some element of compensation to the "profitability" of the operation.

A variety of cost allocation and chargeback mechanisms are derived from this paradigm, designed to make computer centers more or less responsible to their users. To a degree, the use of performance measurement is an alternative, or possibly a complement, which recognizes the practical difficulty, and political unreality, of implementing these approaches in some academic communities.

One problem with the market approach is that it is premised upon the sovereign consumer who knowledgeably chooses among alternatives. In fact, most academic administrators today have at best a faint notion of what to expect from computing and want little to do with it.

Ideally, chargeback provides management information to the center director while encouraging economy on the part of all concerned, leading to the selection of the most cost-effective options within computing and between it and alternatives. Even in its less potent implementations such as cost allocation, there is an awareness of ones impact on resource use which ameliorates the otherwise unslaked demand for more service while simultaneously encouraging support of the necessary budget.

The appropriateness of the market model is strained in the academic environment where there is no profit incentive and the multiplicity of nominal institutional goals is poorly defined. Management oversight is often diffuse and in times of budgetary stress likely to consist of mandates rather than reliance on budgetary autonomy. Particularly in the administrative arena, there is strong interdependence among uses and users which mitigates against untrammeled freedom of choice. In fact users are not viewed as equally important or meritorious, and there is a preference for the security of the known mandate rather than the unsettling risk of innovation or free choice.

Temple lies near the extreme of nonreliance on the market based approach. At the present the center director juggles his resources to meet the perceived needs of key users which are negotiated in a highly politicized environment. On the one hand, given the absence of clear cut expectations, he does have comparative freedom to function as he believes most appropriate. On the other hand, he know he can anticipate endless administrative review - generally long after the fact-by individuals not well versed in computing who will try to second guess him.

Fiscal Climate

Most academic computing centers function in an environment of fiscal austerty. They simulatnaeusly are pressed for more services while finding their budgets threatened. It is essential to develop a mechanism reflecting to the user the impact of his potential decisions on computing resources, and educating the top administration on the real effects of proposed budget cuts. One ought to distinguish strategic budget games in which one threatens sensitive service reductions to generate short run savings in ones own arena from the need for a genuine assessment of long run total cost implications of alternative resource allocations.

A particularly vexing question in the tight budget environment involves the solicitation of new uses/users which you believe would benefit from computing services.

This is exacerbated if they involve politically weak departments or unpopular causes. One has an institutional responsibility to educate administrators on the benefits of new applications without becoming a computational Don Quixote.

Charting progress in systems development is especially complex. The high level administrator whose cachet is necessary for acceptance is removed from the process which is attended to by operating level individuals who lack the broad perspective and tend to protect parochial interests and maintain old ways of doing business. The process is also victim of the Smith/Jones phenomena. If the Jones system has a feature I want it and if the Smiths use that procedure we couldn't adopt it. The elaborate committee structure tends to lead to the Chinese menu approach to systems definitions in which the box marked 'all of the above' is inevitably selected. The center director must adopt a position somewhere between the benevolent dictator who knows the 'right' answer and completely caving in to all requests.

Regardless of the mechanisms for for judging and determining performance, ultimately one requires high level decisions on the allocation of resources to computing as a whole, and in particular to the development of major new initiatives. In fact most instituions do not take a unified view of computing resources and practice some form of incremental budgeting. This leaves the center director to compete with other unit heads without clear cut directives. In this environment one frequently finds that major users are trying to wrest dollars from the center while simultaneously pressing for new systems to relieve their service burdens.

Performance Criteria

A well designed set of performance criteria should serve the dual functions of providing a mutually compatible operating environment as well as after-the-fact accountability for both the purveyor of computing services and the user. Clearly the center needs a set of marching orders which defines the user's realistic expectations and is consistent with available resources. Perodically actual performance must be assessed against these standards in an objective fashion. Equally significant, however, the user must commit to a set of directives which describe his own contributions to what is in fact a joint activity. User performance should also be monitored and evaluated, both to assess accurately responsibility for failures and to provide a basis for system modifications to avoid them in the future. Higher level management may be at least as interested in using performance data to examine the users use of the system as the center's maintenance of it.

Particularly in an on-line, data base environment, responsibility for data quality and timeliness must be clearly assigned. In many cases, the naive user may be his own worst enemy, and the center must be prepared to protect him from himself.

The existence of facilities management, as opposed to in-house, does not significantly after the need for performance measurement. It may however, heighten the perceived need for assessing performance and strengthen the sense of accountability, particularly if payment is affected by it.

One difficulty with actually assessing performance is that in a public forum users may subscribe to goals which are consistent with generally recognized University objectives while privately assessing performance by more parochial criteria. Far from preferring objective accountability, the powerful administrator may be happier with the backroom agreement which satisfies his narrow demands of the moment.

Particularly if part of the evaluation consists of post hoc questionaires to elicit feelings of user sentiment, one may find that the assessment itself is inconsistent. While surveys are important, one should recognize their common failings of poor and biassed responses, in which most recent if less significant, events loom large in the users mind. Anonymity of answers may also lead to irresponsible commentary, particularly if the users themselves have performed poorly.

One intriguing query reminiscent of the old question whether a sound is made by tree falling in an uninhabited forest is whether there is a failure to perform if the user doesn't perceive one. If a system recovers from a problem unknown to the user, is that a 'problem' to be reported or a plus for the system. Conversely if a user fouls up due to an unwieldy system, is that necessarily the user's fault?

Charging Administrative Environment

It may be instructive to contrast the academic user community with the administrative. At least at Temple, the former are generally more satisfied with the current state of computing services. This is primarily due to their superior technical understanding and their ability to enunciate precisely what they want. In general they want a stable utility for their use and their only cry is 'more'. Administrative 'users' never come near the computer, don't speak its language and have a hard time knowing what it is reasonable to ask from computing. Traditionally, computer centers provided education and documentation to enable academics to solve their own problems while keeping administrators dumb so their services would be needed.

Changing hardware and software technology will profoundly alter the situation. On-line systems will obviate a major source of dependence in data entry. By the same token, they will generate new demands for reliability, recoverability and backup. A well designed report generator may similarly reduce problems of data exit - commonly referred to by the euphemism 'special requests'. This will enhance the need for documentation, education, and security. The emergence of fourth generation languages will even shift the locus of new system generation from the center to the user, especially in a data base environment. This may enable the emergence of genuine MIS (management information systems) as opposed to OIS (operational information systems). The goal will change from one of measurable identical throughput to one of flexibility - "I will never do the same thing twice".

The movement away from batch processing will reduce problems of scheduling and create a new problem of synchronization. The administrative work load will no longer be neatly predictable and malleable, rather it will be *ad hoc* and peaking. This will make machine usage less efficient which is probably desirable given the relative trends in people and hardware costs.

Analogously we will see the proliferation of micros and minis in administrative offices. Why do people who don't currently know a bit from a byte want to operate their own hardware? Are they crazy or do they know something that we don't? Big machines are by most standards technically superior and probably cheaper. They could do almost anything better than the little ones... but they don't. The key is that distributed processing offers a feeling of control over ones own destiny which has been notably absent from centralized computing. In the broadest sense, if we define success as making the users happy, then the apparent flexibility and user friendliness of small machines may well make them more efficient. Paranthetically this should make users more tolerant of computing center problems. A bursar with an Apple II on his desk is more likely to sympathize with the message that a head crash has delayed the receivables run. In sum, the academics and administrators are becoming more alike in their demand for services.

Concerns

A significant concern in the implementation of performance measurement is the potential distortion of incentives caused by stressing quantitative indices. If taken literally, emphasis on volume measures could make efficiency enhancing modifications appear unattractive. In a broader sense it is no longer clear that machine efficiency is the most important goal. It may cost more people money than it saves in hardware dollars to produce optimized COBOL code making minimal demands on storage. Particularly as one moves into on-line processing, can one even say whether a user consuming more machine cycles is bad (chewing up the machine) or good (making use of computing). More importantly in a system stressing mechanical measures one may fall into the trap of centrally planned economics where quality and innovation are sacrificed to meet the targets.

Ironically the ultimate goal of performance measurement should be its own dissolution when we reach an era where users are all self-sufficient and independent, plugged into a utility which provides power on demand.

Performance Criteria for Administrative Systems Services

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This paper suggests criteria by which the administrative systems services of a university computing center might be measured. The paper outlines a variety of measures for each category. Potential services fall into two broad categories:

- Production activities - services associated with the ongoing operation of existing administrative systems; and support of the user community via existing mechanisms;
- Systems development activities - services oriented to the modification and enhancement of administrative sytems, and creation of new facilities and modes of operation.

The paper defines a number of criteria in each of the above areas and suggests mechanisms for arriving at measurable objectives in each category against which performance can be monitored. The approach suggested encourages a continuous process of goal definition, service delivery, user feedback and subsequent redefinition of needs.

A. INTRODUCTION

This paper suggests criteria by which the performance of an institution's administrative computer center might be measured. The authors believe that computer center activities are best measured against a series of public, quantitative goals and objectives. Such goals and objectives must be developed through the cooperative effort of the computer center, the user community, and senior institution executives.

Computer center activities in support of the administrative community can be divided into two broad categories:

- Production activities - activities associated with the operation and execution of existing administrative systems;
- Maintenance, user liaison and systems development activities - activities directed to the modification, enhancement or development of administrative systems.

B. PRODUCTION ACTIVITIES

Production activities are those activities associated with the operation of existing computer programs and systems. Such activities are usually performed by a computer center's operations group and usually involve production control and computer room staff. In general, production activities are regular and easily measured by a few simple manual procedures and by measures derived directly from the operating system. This section details a number of measures which can be implemented simply and quickly and highlights measures which are appropriate to the performance evaluation of interactive systems.

The authors recommend that performance be measured by broad categories of users. One suggestion for such user categories is:

- Student information related systems
- Finance systems
- Human resource information systems
- Other systems

The precise definition of the systems to fall within each of the above categories (or the categories themselves) should be made in accordance with the organization and management traditions of each institution.

1. Number of Scheduled Jobs by "User Family"

   A scheduled job is defined as the execution of a pre-existing program or system which is requested as part of the computer center's normal scheduling procedure. A "budget" can be developed for the number of scheduled jobs to be executed each quarter. Computer center performance can be measured by comparing the actual number of scheduled jobs executed, in the quarter, against the budgeted number for that quarter.

2. Percent On-Time Delivery for Scheduled Jobs by "User Family"

   This measure compares the number of scheduled jobs delivered on time (i.e., at the time requested by the user) with the total number of scheduled jobs executed. This is a measure of the computer center's reliability with respect to the delivery of administrative systems output.

3. Number of Unscheduled Jobs by "User Family"

   An unscheduled job is the execution of the existing program or system whose execution is requested apart from the computer center's normal scheduling procedure. This criterion measures the computer center's ability to execute ad hoc requests. A "budget" can be developed for each quarter, and the computer center's performance can be measured by comparing the actual number of unscheduled jobs executed against budget for that quarter.

4. Time in Queue for Unscheduled Jobs

   This criterion measures the number of days required to return output from unscheduled jobs. The "time in queue" distribution is a measure of the computer center's ability to respond rapidly to unscheduled user requests. The distribution shows the number of unscheduled jobs which required: 1,2,3,... thru "n" days to be executed.

5. Percent Hardware Availability

   This criterion measures the percent availability of computer hardware. As such, it is a measure of the reliability of the hardware/software configuration which supports the administrative community. The measure compares scheduled hours available with actual hours available.

Additional measures of performance are required by extensive use of interactive administrative systems. Some suggested interactive performance criterial are:

6. Number of Interactive Transactions Processed

   This criterion measures the number of inquiries and updates processed by various interactive systems. This is a measure of the computer center's ability to process interactive system work load. A "budget" for the number of transactions to be processd can be developed for each quarter; the actual number of transactions processed in that period can then be compared against those budgeted.

7. Response Time

Response time is a measure of the time required for an interactive system to process an individual transaction. Response time is usually measured by the computer's operating system or transaction monitor. Typically, administrative systems strive for response time on the order of 5 seconds or less.

8. Percent Availability of Interactive Systems Central Site Hardware

This criterion is a measure of actual versus scheduled time available for the central site computer hardware. This measure is similar to the performance measure outlined in 5 above. Since a failure of the central site hardware implies failure of all interactive systems support, this measure should be maintained separately as an important measure of interactive systems reliability.

9. Number of Network Failures

This criteria measures the number of equipment and software failures associated with individual terminals and controllers within the administrative communications network. Network equipment failures constitute a measure of reliability of the interactive system hardware from the perspective of the individual user.

C. MAINTENANCE, USER LIAISON AND DEVELOPMENT ACTIVITY

These activities are usually performed by the computer center's programmers, analysts and managers. These activities cover a broad range of functions including programming, system design, system specification and user liaison. Activities included under the general title of maintenance, systems development, etc., are generally more difficult to measure in a statistical sense than those associated with production activities. Man-hour budgets by quarter can be established by each of the broad categories by "user family". Actual man-hours dedicated to these tasks thus become a meaningful measure of the computer center's efforts by type of function by user category. Some suggested categories for measuring activities are:

1. Remedial Activities

Remedial activities are those activities associated with the correction of production failures, program failures, input errors, etc. In essense these are "fire fighting" tasks required to maintain the smooth operation of administrative systems. In an "ideal world" such activities would not be required; however, in the "real world" activities such as these occur frequently.

2. Maintenance Activities

Maintenance activities include such functions as design, programming, documentation and operational changes mandated by external agencies to existing administrative systems and programs. The key to the definition of this category is the mandated nature of such changes. As an example, pay rate changes mandated by union negotiations, or grade changes mandated by the faculty senate are considered maintenance changes. The authors suggest two sub-categories be defined:

- Small scale maintenance - those maintenance activities which require less than 10 man-days effort;
- Large scale maintenance activities - those maintenance activities which require more than 10 days effort.

3. Enhancement Activities

Enhancement activities include such functions as design, programming, documentation and operational changes made on request to enhance the value of a pre-existing administrative system or program. Key to definition of an enhancement is the non-mandated or voluntary nature of the activity. The authors suggest that enhancement activities also be circumscribed by some man-day limit on the size of these projects. For example, enchancements might be defined as those projects or changes which require fewer than 90 man-days effort.

4. Ad Hoc Requests

Ad hoc requests are essentially small scale requests for special reports or processes which may involve programming or extensive job set-up for pre-existing programs. Such requests typically require close coordination between user liaison, programming and production control staff. By their very nature ad hoc requests are small scale (usually fewer than 10 days, more typically fewer than 5 days).

A further qualification on the concept of the ad hoc request is that it typically requires that data be extracted from existing data files (data bases) rather than the implementation of programs or procedures to provide data to such files.

5. User Liaison Activity

This is a general category for administrative systems activities and includes such activities as general interaction between computer center staff and the administrative user community. Typical activity includes production scheduling, user training, small-scale feasibility studies and the preparation and refinement of user documentation. Feasibility studies conducted within this category are typically small-scale; i.e., fewer than 10 to 15 man-days duration. Larger feasibility studies should be included under the category "Systems Development".

6. Systems Development

This category of activity includes such efforts as design, specification, programming, and documentation of new administrative applications. The category also is designed to include large scale enhancement activities; i.e. those requiring more than 90 man-days effort. Large-scale feasibility studies (those requiring more than 15 man-days) are also included in this category.

D. OTHER PERFORMANCE CRITERIA

In addition to the criteria suggested above, the authors suggest that two additional measures of performance be instituted. The first of these requires the joint development (user and computer center) of major objectives and goals for a planning year. Typically, these goals would include implementation of a major administrative system, or the completion of a major phase in the development of a major administrative system. Other goals and objectives which might be included are major improvements in user documentation, etc. By their very nature, these major objectives and goals are not easily quantified.

The authors recommend that such goals and objectives be succinctly stated and be limited to no more than 8 or 10 such goals and objectives during a planning year.

The authors recommend that a user attitude survey be developed and administered to the administrative user community. The survey instrument should be short (no more than 20 questions) and allow ample opportunity for users to express opinions or suggestions. The survey instrument should be administered to three broad categories of administrative systems users:

- Senior management
- Supervisory staff
- Clerical and office staff directly involved in interactions with administrative systems.

By stratifying the survey, administrative systems performance can be measured as viewed by three different levels of users. Differing perceptions between and amongst the surveyed categories can highlight the impact of strategic decisions on tactical operations.

PEOPLE & CHANGE

Success in Implementing Administrative Systems

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DECEMBER, 1981

The key to success in implementing administrative systems in higher education (and probably any place else) is dealing effectively with people in relation to change. It is a real challenge to convince people in user departments to analyze and articulate their real requirements, to cooperate in choosing an alternative solution, and to change their way of doing their job, all while they also must continue doing day-to-day business as usual. We believe that we have accomplished this at the San Diego Community College District (SDCCD), implementing successfully three major new systems over the last two years with another in process at this time.

The following represent the key elements in these successful efforts:

1. Top-Level Support
2. General Requirements Definition
3. Prototype (Baseline) System
4. User Task Force
5. User Liaision

- The SDCCD Environment -

The SDCCD is a large, multi-campus district with a total budget approaching $100 million. The District consists of five major academic units:

- o Three two-year colleges:
    - oo City College
    - oo Mesa College
    - oo Miramar College
- o Two adult education divisions:
    - oo Educational & Cultural Complex (ECC)
    - oo Adult Education Division

The District's total student enrollment exceeded 100,000 students in the fall term of 1981, about half being college students and the other half being adult education students. The District employs a total of 5 to 6 thousand people.

The District's central administration is lead by a Chancellor with a cabinet consisting of Directors, representing each of the various functional operations, e.g., Student Services, Business Services, etc., and the Presidents of the academic units. Computing Services reports to the Director of Administrative Services, who is a member of the Chancellor's Cabinet. Computing Services is staffed and managed under contract with Systems & Computer Technology Corporation.

Computing Services supports both administrative systems and academic computing with advice from a governance structure consisting of a Computer Policy Committee, and Administrative Systems Advisory Committee, and an

Academic Computing Advisory Committee. Computing Services has a staff of 27 people operating a Univac 90/80 central computer with a District-wide telecommunications network of over 120 terminals. The budget for Computing Services is approximately $1.6 million.

The following indicates the significant computing events over the past few years, and projected into 1982:

7/01/79	Implemented the batch IAI Payroll/Personnel System.
9/01/79	Entered into a Facilities Management Contract with SCT.
4/01/80	Implemented on-line capabilities in Payroll/Personnel.
9/01/80	Began implementation of SCT's on-line, data base ISIS with the Master Catalog and Class Scheulde.
9/01/80	Installed a major hardware upgrade.
12/01/80	Registered students on-line.
1/01/81	Implemented SCT's Fund Accounting System (FAS).
4/01/81	Completed implementation of ISIS.
7/01/81	Completed implementation of FAS.
2/01/82	Implement SCT's on-line, data base Budget Preparation System.
6/01/82	Implement SCT's ISIS for Adult Education.

- The Keys To Success -

There are many reasons for this success in implementing systems. However, we believe that the key is in dealing effectively with people in relation to change. The following are some of the important aspects of this whole systems implementation process:

1. Top-Level Support - There was a concensus of Board members and top administrators that new systems must be implemented to meet the operational and management needs of the 80's. This translated into the allocation of all the needed resources, people's time, political clout, and dollars. There was also a great deal of interest and involvement in these projects at all levels. This attention enhanced the prospects of success. In addition, there was a realistic understanding of the commitments required and a willingness to take the time to make intelligent decisions.
2. General Requirements Definition - Agreement was reached early in the process on the general requirements in the various areas at a general level. This allowed the examination of alternative approaches and the selection of one at an early point in time. The District decided to acquire professional assistance in this process and to adopt the approach of seeking out and installing a "base-line" system which would meet the highest percentage of the District requirements It was decided that only mandatory changes would be made initially and all other changes made after the system was in operation. There was dedicated involvement by the key users who were willing to work hard to achieve concensus on these general requirements.

3. Baseline System - The selected baseline system in each case was than quickly installed 'as is' on the District's computer. This allowed the definition of detailed requirements by use of this baseline system. This established credibility with users and facilitated the detailed specifications process. This part of the process was greatly facilitated by user-oriented and service-oriented Computing Services and Contractor staff. The fact that the baseline system was working someplace else made the new system less abstract which gave the users confidence that it would also work here. The users could see that progress was being made and that the probability of success was good.

4. User Task Force - A Task Force of users with a user as Chairperson was established at the initiation of each project. This group became a part of the process, the focal point for decision-making, planning and training and a communications channel to all end users (which in our case numbered in the hundreds). The selection of these users was carefully and thoughtfully carried out by the top administration. A commitment of up to 60% of an individual's time for months was understood and accepted by the individual and his superior. The importance of the Task Force work was stressed and clear guidelines were given, e.g., only mandatory changes, the training and communications channel responsibility, etc. Finally, I believe these people believed in what they were doing and had a lot of fun doing it.

5. User Liaison - A function was established, and a person named, in Computing Services with the responsibility for user satisfaction. This person served as staff to the Task Force during the definition stage, and continued to guide the process through implementation and actual operation of the system. The person in this position must have a strong people orientation with solid subject matter knowledge, and be able to communicate effectively with both users and data processors. The need for, and the credibility of this function cannot be over-emphasized. Computing Services must be perceived by the users to be service oriented and knowledgeable and emphathetic with user problems. This spirit is what really made it happen.

We started this process with cynical and incredulous user department staff who were utilizing ineffective and inefficient first generation data processing systems. We received top-level support for a process involving installation quickly of proven software which most closely met our requirements. We established a structure of user involvement and an attitude that the computing function was there to serve the users. We restricted initial modifications to only mandatory ones and had the new systems as operational as possible. We are now pleased that these same users are proud owners and operators of effective and efficient on-line, data base fourth generation systems.

MANAGEMENT SUCCESS FORMULA

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There are four major objectives for a successful information systems group. First, the users of the information systems should express general satisfaction with the services received. Secondly, the information processing department should be able to execute new projects, maintenance and daily production on schedule. Third, the projects under development should be accomplished within the approved budget. Fourth, the data processing staff should have a low turnover rate.

The information systems organization that successfully achieved the four objectives by completing 1,000 tasks within a four year period, using three systems analysts and six programmers, working normal eight hour days exemplifies the conference theme "People: Creativity and Quality with Technology". This paper will discuss the management formula and practices behind this success story.

The effective management of information resources continues to play an increasingly important role in the survival of universities and colleges. Overall dependence on information systems for daily operation is spreading into each department. The severe impact of missed schedules has injected the need for realism and dependability in the ivory towers of computer technology. The cost of information systems has become a valid management concern. These factors are mandating the change from successful technocrat to successful manager.

In order to be a successful information resource manager you must understand the nature of that role in the organization. Information systems have become an integral part of the university operation. The manager of this service must be involved in the university business to the extent that he can knowledgeably discuss real needs with every department head. Without a basic understanding of departmental objectives accurate decisions on priorities are impossible. Above the individual departmental needs stands the overall university direction which may supercede individual departmental demands.

The establishment of goals for the information support service is the beginning of a management success formula. Without goals individual departmental pressures will create a chaotic environment. Further definition of a management success formula can be divided into four components. First, the service provided must be reliable so that business may be conducted relatively uninterrupted. Second, the projects undertaken should be completed on schedule. Third, the projects should be completed within budget. Fourth, the information systems group's turnover rate must remain low in order to provide continuity of service and to develop an understanding of departmental needs.

The first objective of system reliability is the key to satisfied users. The issue of user satisfaction is a specific problem that must be analyzed and solved. The predominant approach to user satisfaction is to concentrate on providing the latest technology. While it might seem reasonable to equate efficiency with new technology, reliability often is poor in a new product which ultimately decreases overall efficiency. Most managers, given the choice, would select the system that consistently gets the job done instead of one that gets the job done twice as fast, but only part of the time. A department should have a system that performs consistently, allowing the other departmental functions to be completed without interruption from faulty information systems.

Similar to many other management problems user dissatisfaction can be reduced to a lack of free flowing communication. Most users have no understanding of computers and the people that work with them. Coupled with this lack of understanding is the increasing dependence on information systems. These two factors create an unknown and threatening environment. Unless the user can feel confident that the information resource manager understands his business and will take appropriate action, crisis proportion reactions will be the response to most problems. Ask your physician to explain a problem. He says "It's too technical, you wouldn't understand it." The same fears and frustrations of patients whose doctors can't be bothered to explain problems exist for users whose computer people can't be bothered to explain problems in layman's terms. Communication between users and managers of information systems must be open.

The concept of what a system encompasses must take into consideration the whole department, and its interaction with other departments within the University. The information system is only a fraction of a department's activities. Too often computer systems are technically sophisticated, but fail to interface with the departmental organization. The design factors most often ignored are paperflow, various deadline requirements, people's abilities, and willingness to change. The development of a successful automated and manual system is possible with departmental participation in design and implementation. The key factors are involvement, understanding, and a demonstrated concern by the information systems manager for the successful operation of the department being serviced.

Most information systems managers perceive themselves as stifled by politics. The nature of servicing a spectrum of departments certainly creates simultaneous pressures from many directions. The manager of information resources must never forget that both the computer and manpower are limited resources. The impact of information systems on administrative efficiency and their costs warrants upper management attention. It becomes easier to direct the allocation of resources when priorities have been reviewed at the upper management level. Requesting a brief meeting quarterly, not allowing lower level substitutes, may suffice. After the briefing, argumentative departments can be told that service allocation is with upper management approval. A well rounded understanding of university direction must be the guiding force behind the manager's priorities.

Being in a highly technical field has a tendency to create difficulties in communication. Data processing people in general have a reputation for speaking in foreign tongues and being non-conformists. The most important part of the success formula is to come down from the ivory towers of technology in order to be involved and practical. If you can communicate at the departmental level and the upper management level user satisfaction may not necessarily be achieved, but relative peace will exist.

The second objective, that of meeting project schedules, is important because of the impact on the university operation. Information systems projects have a reputation for rarely being completed on time. Three factors contribute to this real problem. First, resource management's inability to accurately estimate the extent of a project. Second, resource management's inability to negotiate the scope of a project. Third, resource management's failure to reduce project interruptions.

The versatility of hardware and software today make it difficult to imagine what can't be computerized. Added to this seemingly unlimited resource are the intense pressures from each department for computerized service. These two factors make it most difficult to keep from over-committing resources. Over commitment must be avoided if success is to be achieved.

Estimating an information systems project should be approached as a quantitative task. The rudimentary components of design, programming, and testing can be broken down into finite time intervals. The unexpected problem is what sets project estimation into the realm of art. However, many interruptions are predictable. If systems analysts and programmers are being called during the night to correct production errors, their ability to perform effectively on a project is obviously limited. If programmers are working at night in order to obtain computer resources, control of the project continues to weaken. These issues must be conquered before any schedule will be met.

Late night production problems do create multi-shift responsibilities. However, this problem must be analyzed and resolved. Batch production streams should be restartable, thus not requiring programmer intervention. If programs are aborting more emphasis must be placed on testing. A list of truly critical jobs should be developed to eliminate unnecessary late night calls for problems that can wait until the morning. This list should be developed with the help of the departments. If a user doesn´t think completion of production is important enough to come in at 3 a.m. himself, why should you?

Quantifying a project´s components is the basis for a realistic schedule. The analysis of schedule failures will uncover the specific delaying factors. Once the problem is defined corrective action can be taken. A project can be controlled if it is executed in the presence of project leaders. When the project is under control, decisions can be made in a timely fashion, keeping the project on schedule.

Many installations are plagued with long hours between turnarounds for programmers. The causes of this inefficiency must be determined and resolved. On-line program development and good daytime turnaround are the only hope for reasonable project control. The future in this area looks very grim from the perspective of daytime turnaround. The continued proliferation of on-line inquiry tools containing no resource usage limits creates a potential response time drain. These systems should be limited to only the most critical departmental needs.

The third objective of running projects within budget has become more critical in these austere years. The entire function of resource management is based upon the finite limits of both manpower and equipment capacity. The manager's time is also finite. Therefore a management philosophy must be a balance between desired controls and available time. Carrying this philosophy into the project justification area presents an interesting question. How much time is spent cost justifying projects which could have been spent doing projects?

Reducing the administrative burden of cost justification frees time to control projects, thus improving your track record. The delicate balance of control versus freedom of action must be maintained, aimed at maximizing available time for accomplishing information systems.

The fourth objective of low staff turnover is the final key to management success. In order to be a high performance operation the environment must be created to expect and develop exceptional performance. In general people desire boundaries and secretly lust after being needed. The salary issue is the most predominate concern in many personnel discussions. However, at a certain salary threshold people will be able to live at a level at which basic existence is not threatened. Above this threshold many other factors come into play. Establish a career path with at least annual reviews not only of technical abilities, but of attitudes. The employee should be required to review his own performance realistically. In most cases his own self examination will reflect the areas for improvement and decrease the need for the manager to originate comments on weak performance. People should be given responsibilities and the necessary background information to make good decisions. The manager should set an example for his staff. The minimum expectations for desired performance should be made clear to each employee, and growth must be encouraged. A normal daytime working environment should be created, with a smooth operation as the ideal, rather than all night martyrism. People will respond if you manage and supervise.

This success formula has evolved over a four year period. Between May 1977 and May 1981, 1,000 tasks were completed by three systems analysts and six programmers. The average experience level for the systems analysts was ten years and less than two years for the programmers. The length of an individual task ranged from a half day to six months. Ten systems were maintained during this period. In addition to the maintenance, new systems were developed in the areas of financial aid, work/study, registration, and telephone bill analysis. A new on-line front-end was developed for payroll. A package was customized for fund raising and alumni. All of the systems are developed using COBOL. On-line systems are developed using a library of cursor addressing routines. Some four thousand pages of documentation were written. Each programmer has his own terminal for on-line program development. The following tables give a breakdown of activity:

ADMINISTRATIVE SYSTEMS TASKS COMPLETED

	1981	1980	1979	1978	1977
JAN	15	31	22	17	**
FEB	21	28	18	7	**
MAR	13	30	15	15	**
APR	21	27	8	19	**
MAY	15	38	20	11	9
JUN	27	42	25	18	9
JUL	13	44	27	14	15
AUG	12	32	30	34	7
SEP	33	29	14	20	16
OCT	78	38	29	10	13
NOV	25	21	26	36	6
DEC		18	7	17	12
**TOTALS	273	378	241	218	89

SYSTEMS	EXISTING MODULES	TASKS IN PROGRESS	TASKS WAITING	TASKS COMPLETE 1981	TOTAL TASKS
ACCOUNTING	(68)	1	8	6	15
ADMISSIONS	(30)	0	2	6	8
DEVELOPMENT/ALUMNI	(53)	4	9	40	53
FACILITY INVENTORY	(8)	0	4	1	5
FINANCIAL AID	(34)	0	8	15	23
HOUSING	(29)	0	9	15	24
LIBRARY	(20)	1	3	2	6
ORIENTATION	(7)	0	4	2	6
PAYROLL	(69)	3	12	22	37
REGISTRATION	(83)	6	9	59	74
STUDENT ACCTS.(OLD)	(0)	0	0	4	4
STUDENT ACCTS.(NEW)	(47)	6	4	90	100
TELEPHONE ANALYSIS	(5)	0	0	0	0
WORK/STUDY	(5)	1	2	3	6
MISCELLANEOUS	(49)	0	1	7	8
**TOTALS	(507)	22	75	272	369

The serviced departments are required to submit project requests. The submitted projects are evaluated and placed on a waiting list itemized by department. The average number of tasks waiting is one hundred. The departments are not allowed to use the computer as an excuse for every departmental problem. The communication between the departments and the information systems group is by telephone or in person. Tasks are evaluated on the basis of their overall benefit to the university. Major priorities are reviewed with all of the vice presidents each quarter. The aim of these policies and procedures is to determine the actual need for information systems. The management of a limited and valuable resource is the foundation of all philosophies.

The analytic and problem solving abilities of the information systems group must also be focused inwardly to correct its own operational problems along with those of serviced departments. In summary the management of information resources success formula is good management.

TRACK III
THE EMERGING TECHNOLOGY

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VISICALC BUDGETING

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ABSTRACT

This presentation included:

1) A brief overview of the University of Nevada System budgeting process. The UNS includes two universities, four community colleges, and a research institute.

2) A description of the VISICALC package software which is available for use on several popular micro-computers.

3) A demonstration of the use of VISICALC as a modeling tool and budget preparation tool within the University of Nevada system.

1. The University of Nevada System includes the following institutions, organizations and research facilities:

	FTE	HEAD COUNT
System Offices (Chancellor, Computing Center, University Press)	N/A	N/A
University of Nevada, Reno	8,197	9,253
University of Nevada, Las Vegas	7,439	10,544
Truckee Meadows Community College	2,469	7,639
Northern Nevada Community College	351	1,446
Western Nevada Community College	879	2,842
Clark County Community College	**	**
Desert Research Insititute	N/A	N/A
TOTAL	19,335 +	31,724 +

**(Totals were unavail)

(The above enrollment figures are unofficial estimates)

II. The University of Nevada System is served by a centralized Computer Network, which fills administrative, research and academic needs. The network includes the following equipment:

LOCATION	EQUIPMENT
Computing Center (Reno)	Cyber 171
Computing Center (LV)	Cyber 73
Univ of Nevada, Reno	Remote Batch Terminal
DRI (Dandini Park, Reno)	Remote Batch Terminal
DRI (Stead)	Remote Batch Terminal
DRI (Boulder City)	Remote Batch Terminal
CCCC (Las Vegas)	VAX
NNCC (Elko)	Remote Batch Terminal
WNCC (Carson City)	Remote Batch Terminal

Plus various mini/micros located throughout the state.

III. The University of Nevada System operates under a single Board of Regents. State funding is provided by the State Legislature, which meets every two years.

As a result of a 1977 Legislative mandate, the University Biennial Budget Request is submitted in a line item format. That is, every unique administrative, academic and research position is shown as a separate line item. Although formulas are used by the State Budget Office and the Legislature in developing the final University Budget, these formulas are not known to the University during the budget preparation phase. As a consequence, development of the budget is a highly iterative process from the time a department initiates a request until the total University Budget is approved by the Legislature.

Also as a consequence of this process, the University must be prepared to answer a myriad of "what if" questions posed by the State Budget Office and the State Legislature. The University of Nevada System is currently in the process of developing an automated budgeting system. The elements of that system will include:

1. Position Control System.
2. Budget Preparation System.
3. Budget Modeling Capability.

Our approach to the system development is to utilize package software, if availble, otherwise develop the programs "in-house". It appears that a software product called "VISICALC" may fulfill our requirements for "budget modeling".

VISICALC was developed by Daniel S. Bricklin, executive vice-president of Software Arts, Inc of Cambridge, Mass. He received the Grace Murray Hopper Award on November 9 at the annual conference of the Association for Computing Machinery (ACM). The award, given in recognition of computing achievement made by a person before his 30th birthday, cites Bricklin for "his contributions to personal computing and, in particular, to the design of Visicalc." Bricklin conceived the concept of the "Visual Calculator" while attending Harvard Business School. the program was written by Robert Frankston, now president of Software Arts.[1]

Our purpose in presenting this demonstration is to not only share our ideas, but to solicit additional ideas from our peers. With this in mind, we will demonstrate the general capability of VISICALC, followed by a demonstration of a specific example of its intended use in the University of Nevada System budget modeling.

IV. Visicalc consists of a matrix composed of 63 columns and 254 rows. Thus, over 16,000 individual elements are available in the matrix. Each element of the matrix may contain an alphanumeric label, a numeric constant, or a formula.

Formulas within each element may be based on numeric constants and formulas found in other elements of the matrix. For example, the last element in a column may contain a formula to derive the sum of values found in every element of that column. The limit of the use of this formula driven matrix rests with the imagination of the user. In the case of problems involving budgeting, a complete formula driven budget could be established.

When an element within the matrix is changed, every element that is driven by a formula which is affected by the changed element will be re-calculated and re-displayed.

New columns and new rows may be inserted within the matrix at any time. The relative element addresses of affected rows or columns will be recalculated to accomodate the new row/column.

If a series of elements contain formulas which differ only by their relative element references, they may be "replicated" quickly and easily without laborious rekeying.

Data and formulas entered into the matrix may be saved on floppy disk for later recall or disposed to an attached printer.

V. Visicalc is available for most of the popular micro-computers, such as Apple, Radio Shack, Pet, and the new IBM Personal Computer. With the abundance of micros within the University environment, hardware is normally available. We felt that a $200 investment for software which seemingly is an extremely powerful budget modeling tool, is a rare bargain. Although there are very few "free lunches" available in data processing, we had to give this one a hard look.

Although results are not in, we will continue to include this software package within our overall plan.

1 Article,"Computer World", 1981, Page30

Modeling with VisiCalc[1] and EFPM: A Possible Synthesis

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Interest in modeling with microcomputers and VisiCalc is not limited to the CAUSE Conference. In fact, VisiCalc appears to be the widest selling applications software package in history. Needless to say, EDUCOM has followed this development with interest, since it was only three years ago, at CAUSE '78, that we announced a conceptually similar modeling system, EFPM.[2] EFPM, a time-shared mainframe-based system accessed by remote terminal, is used in over 130 colleges and universities. After a brief overview of modeling systems, I would like to discuss the similarities and differences between the two systems, and then turn to a possible synthesis.

The Case for Modeling Systems

Computer-based models for college and university planning and management are enjoying a resurgence.[3] The large packaged models for resource allocation and prediction were found to be expensive, inflexible, and dependent on technical experts, so attention has turned to systems that permit administrators to design and operate models specific to their own needs. Although several institutions, notably Dartmouth, Pennsylvania, and Stanford, have been successful in building such models in APL, BASIC, or FORTRAN, most administrators lack the programming and systems design skills (or staff) to build models from scratch. Thus there is a need for the so-called "modeling system" that provides the structure for a model without the content.

The desirable characteristics of a modeling system are:[4]

- o Flexibility in defining data elements, equations, and reports.
- o Interactive access for changing assumptions, revising relationships, and displaying results in tabular and graphic formats.
- o Ease of use that permits non-technical administrators to operate the model and (ideally) to build it as well.
- o Low marginal cost to encourage analysis and sensitivity testing.
- o Some limit on the number of data elements that can be defined, so that users are encouraged to build simple, aggregate models rather than overly detailed ones. (Keeping track of detailed data is the function of data base management systems, not modeling systems.)

An early modeling system for higher education, HELP/PLANTRAN, had all these characteristics except for interactive access; predictably, it had limited success. The first interactive modeling systems were designed for -- and priced for -- the corporate market and were little used in colleges and universities. The first widely-used modeling system in higher education was EFPM, the attractiveness of which was due, in part, to the low price made possible by grants to EDUCOM from the Lilly Endowment, Inc.[5]

VisiCalc and EFPM: Similarities

Both VisiCalc and EFPM have the same underlying structure -- a content-free matrix or spread sheet. That is, the user labels the rows and columns, specifies the functional relationships (equations) among the rows and columns, keys in the starting assumptions (exogenous variables), and runs the model to see the values of the calculated (endogenous) variables. "What-if's" can be performed by changing either the starting assumptions ("what if we increase tuition 9% instead of 8%") or the functional relationships ("what if increasing tuition causes enrollment to decline"). Although the typical application uses the matrix columns as time periods (most often years), neither system requires this. Thus the columns might be departments in the same time period, or even different scenarios for the same time period. The critical notion is that the user starts with a blank slate and builds his or her own model from the ground up, piece by piece.

Both systems have another central feature in common -- an integrated editor. That is, building the model and running the model are both foreground functions, with similar syntax. (In some systems, the model is built using a separate editor, then compiled, before it can be run.) Systems that lack this feature are difficult for non-programmers to operate, especially during the model check-out and debugging stage.

There are, of course, many other lesser features in common. Both systems use standard algebraic notation (earlier versions of EFPM used prefix notation); both systems allow discontinuous "step" values (8% the first year, 9% the second year, etc.); both systems provide attractive printed reports; and both systems allow models to be saved and restored from the disk. The number of similarities should not be surprising given the consensus about the functions of modeling systems. As we shall see, the differences focus on technical features and support services.

VisiCalc and EFPM: Differences

The fundamental difference between VisiCalc and EFPM is that VisiCalc runs on microcomputers (Apple, Hewlett-Packard, IBM, Radio Shack, et al.) and EFPM runs on a remote host that users access via terminals, modems, telephones, and data networks (TYMNET and Telenet). (In fact, EFPM is available for local installation on IBM VM/370 CMS systems, but nearly all users use the system remotely.) Many salient differences follow from this:

- Connect time is free for VisiCalc, and is charged for EFPM.

- System problems with VisiCalc are limited to the user's hardware, whereas technical problems for EFPM users can arise in telephone lines, the data networks, and the remote host.

- VisiCalc displays at 9600 baud; EFPM, at 300 or 1200 baud.

- Full-screen cursor control is available for VisiCalc, unavailable for EFPM.

- The calculations are performed faster in EFPM.

- Some calculation-intensive features like EFPM's feasibility searches and tradeoffs are not practical in (the current) VisiCalc.

- System maintenance is the user's responsibility with VisiCalc; maintenance of EFPM is provided by EDUCOM and the host system staff.

- VisiCalc users are (typically) on their own; EFPM users are automatically connected via the network to the EDUCOM user services staff and to other users.

- The purchase price of VisiCalc is lower than that for EFPM because of the wide market available for microcomputer software and the lack of user support. The EFPM subscription fee includes user support.

There are other differences in the software design not dictated by the hardware configuration. These include:

- The VisiCalc matrix is (typically) 254 rows by 63 columns; the EFPM matrix is 560 by 12.

- Calculation in VisiCalc can be row-by row or column-by-column at the user's choice; calculations in EFPM are always column-by-column.

- VisiCalc requires that variables be defined in the order of calculation and report printing; in EFPM both the order of calculation and the order of appearance in reports are independent of the definition order.

- VisiCalc allows different calculations in each column; EFPM requires identical calculations (although conditional expressions could simulate column-specific calculations).

- VisiCalc has one matrix in memory; EFPM has two, a "base " and a "trial", with built-in comparison features.

- VisiCalc reports show the column and row labels and the value matrix itself; EFPM has built-in functions to show absolute and per cent changes, compound per cent changes, row totals, etc.

- VisiCalc has provisions for linkage to a separate graphics package; EFPM has built-in graphics.

- VisiCalc has no inter-model communication; EFPM does.

- VisiCalc runs only in "what-if" mode; EFPM contains the feasibility search and tradeoff features of the Stanford Trades Model.

- VisiCalc lacks the diagnostics and help facilities built in to EFPM.

Finally, there are a critical set of differences related to user support and consultation. VisiCalc users, like most microcomputer software users, are on their own with the hardware, software, and documentation. The local computer store or the computer center might be able to provide technical assistance, but not substantive assistance. That is, our experience suggests that access to a modeling system alone does not turn people into modelers. Some people have, in fact, been modeling for years with paper and pencil, so a modeling system is the answer to their dreams. For many business and planning officers, however, successful modeling will require both start-up and ongoing assistance.

Not surprisingly, EDUCOM has had to provide such service to support the EFPM users. EFPM staff provides on-site consulting on model design, operation, and interpretation; telephone and electronic mail assistance; and active facilitation of a newsletter and User Group meetings. EDUNET staff provides assistance in account handling, file storage, and use of the networks. In addition, EFPM users have access to an online library of demonstration models, many based on live user models, and convenient facilities for sharing models and institutional data.[6]

In summary, VisiCalc is cheaper, simpler, and easier to learn; EFPM is more powerful and better supported. Can the best features of each system be combined? We think so.

A Synthesis

In terms of user support, EDUCOM is willing to offer both on-site consulting and ongoing support for micro-based modeling. In fact, we have already provided such assistance for theological seminaries in a special project funded by the Lilly Endowment. On-site consulting and workshops are available at our standard rates; a fee for ongoing support will be announced shortly. Those interested in support are encouraged to contact us for discussion of hardware options (as remote consulting would be enhanced if the micro had communications features) and modeling software (as it is predicted that VisiCalc will soon have over 50 competitors).

In terms of software power, our plan is to offer an automatic file transfer and conversion capability, so VisiCalc models could be "up-loaded" to EFPM to take advantage of the diagnostics, report writing, feasibility search, and graphics features. In this way, users could have the advantages of both systems. This capability should be available by Fall, 1982.

Organizations like CAUSE and EDUCOM exist to promote cooperation and resource sharing. A powerful mechanism for this is a data communications network. Networks can be even more powerful if users have microcomputers rather than ordinary terminals as their links to the network, and if the microcomputer software is compatible with the network software. Finally, our EFPM experience suggests that a central user services staff is necessary for many users, particularly the non-technical administrators most in need of computer models. It is this combination of micros, networks, and user services that EDUCOM envisions as the ideal environment for modeling in the Eighties.

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1. VisiCalc™ is a copyrighted software product of Personal Software, Inc., Sunnyvale, CA 94086.

2. A.M. Jones and D.A. Updegrove. "EFPM: In Use Over EDUNET". Presented at Cause '78, New Orleans.

3. D.S.P. Hopkins and W.F. Massy. Planning Models for Colleges and Universities. Stanford: Stanford University Press, 1981; J.B. Wyatt, J.C. Emery, and C.P. Landis. Financial Planning Models: Concepts and Case Studies in Colleges and Universities. Princeton: EDUCOM, 1979.

4. S.D. Bloomfield and D.A. Updegrove. "Modeling for Insight, Not Numbers". J. Wilson (ed.) New Directions for Higher Education: Management Science Applications to Academic Administration, no. 35. San Francisco: Jossey-Bass, September 1981.

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AN INTEGRATED UNIVERSITY ON-LINE/DATA BASE SYSTEM: A REALITY

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ABSTRACT

This paper provides a management perspective on the design of an integrated university on-line/data base system, the core of the system being a central name and address file.

Information can be obtained from the following areas: student records, financial aid, student loans, personnel/payroll, effort certification, alumni/development, product descriptions, stores/supplies inventory, property inventory, facilities inventory, planned equipment maintenance, work orders, library catalog, and book circulation. Future implementations will include billing/receivables, purchasing/payables/receiving, budget/position control, and accounting.

This paper presents the implementation plan, the data base design and data relationships, and the benefits that are achievable through an integrated on-line/data base approach to a university information system.

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St. Louis, Missouri

INTRODUCTION

Washington State University decided to adopt the data base approach to system development in the fall of 1978. At that time, the University had six major problems which could not be solved by continuing with the past development approach. Previously, systems had been built to satisfy the stated needs of particular administrative offices. Most of the systems were independent, batch oriented, and outdated having been developed prior to 1972. The specific problems which influenced the decision to change development strategies were:

1) The entire staff of analysts and programmers was consumed by system maintenance and minor enhancements. Traditional programming techniques made seemingly simple requests difficult to satisfy.

2) Customers relied heavily on the data processing staff to explain the operations of each system and train their new staff. The customers did not have the knowledge or control of their systems and data.

3) State and Federal agencies were asking more frequently for information which crossed office and application boundaries. The inability to coordinate data from one office with that from another, due to different record identification schemes and redundant or conflicting coding of the same information, forced very complex programming to comply with these requests for information.

4) Considerable university staff effort was being spent repeating the same task in different systems, e.g., changing an address or processing a personnel action form. The redundant storage of data and procedures to update that data frequently resulted in different answers to the same question. Overlapping system definitions also contributed to the problem. For instance, the personnel offices were keeping track of positions in their personnel system.

The Budget Office was keeping track of positions in its position control system. And the colleges were keeping track of positions in their management systems. The question of unspent salary monies was answered in three different ways.

5) Administrative office staff productivity was declining. The paperwork to administer the university was burying the central administration. Six and eight copies of various forms were being routed everywhere with the attendant problems of delay and lost paperwork causing considerable frustration. At a time of declining budgets when a greater percentage of money needed to be channeled to instruction and research, the administrative functions were requiring increased staffing to offset the declining productivity.

6) Two systems, Financial Aid and Student Loans, were so outdated that they could not be made to comply with new federal guidelines without major redesign and reprogramming. The federal government A-21 effort certification requirements and State legislated new reporting requirements for Personnel/Payroll and inventory could not be met by the old systems. The University had little choice but to launch a major development effort.

Since commercially available data base management systems had proven themselves to be reliable and cost competitive with alternative methods of storing and indexing data, the university announced a major program to eliminate the data redundancy, improve the accuracy and consistency of its reports, and make information more readily available to all administrative units. This effort had the stated objective of increasing staff productivity and reducing paperwork. A five-year plan was adopted in January, 1979 to implement the new online/data base approach throughout the university. This paper presents the implementation plan, the data base design and data relationships, and the benefits that are achievable through an integrated on-line/data base approach to a university information system.

IMPLEMENTATION PLAN

In order to free some existing staff to do new development, the office was reorganized. The size of the maintenance group was reduced to discourage all but critical changes. In addition, a self-sustaining fund was established to allow expansion of the overall staff commensurate with the demand and availability of special funding for new development.

In order to improve data availability, as well as take advantage of the declining costs of online storage and computer CPU cycles, the following processing priorities were established:

Input	Output
1. On-Line	1. On-Line
2. Optical Scanning	2. Microfiche
3. Key-to-Disk	3. Paper

All data would be on-line with customer terminals available for input and access. Tapes would be used for backup and historical files where necessary.

The terms "data feeder" and "data processing" were defined to differentiate between the procedures for gathering or preparing data and the processing of data. In many instances, these functions were performed by separate organizations. For example, Central Stores, which inventories most of the university's supplies, prepared invoices as items were sold. These invoices were periodically sent to the central accounting section of the Controller's Office for processing. Central Stores performs a "data feeder" function and the central accounting section the "data processing" function. Areas selected for initial data base implementation were those which primarily performed "data feeder" functions. These included stores inventory, physical plant, admissions, financial aids, registration, and other service units. The logic behind this approach was that efficient "data feeder" procedures must be established before accurate and timely "data processing" functions could be implemented. Daily accounting reports are not useful if the previous two weeks of activity are not included.

As various systems and files were designed and implemented within the data base, the need for decisions and policies on behalf of the entire institution became more acute. A Data Base Policy Recommendation Board was formed to develop University policy related to machine readable data. The Board prepares recommendations on continuing and specific issues for approval by the Provost. To insure that this Board be representative of the informational needs of the university, the following members were appointed by the Provost:

Assistant Vice President, Finance
Associate Dean, College of Engineering
Dean of Students
Director of Budget
Registrar

The Director and Data Base Manager of University Computing Services were appointed as ex-officio members of the Board to provide technical consulting and general support. The Board elected the Assistant Vice President, Finance, as its Chair. Some of the types of issues that have been addressed by the Board that affect the entire university include: common building name abbreviations, common organizational unit name abbreviations, consistent formatting of personal names, data security and access privileges, data conversion plans, uniform student and employee record identification, and central name and address change office procedures.

These preliminary implementation decisions formed the foundation for development of the university on-line/data base system.

DATA BASE DESIGN AND DATA RELATIONSHIPS

The initial step in designing the data base was a compilation of activities performed within the University. No attention was given to the office or organization performing the activity. Many activities are done by more than one office. These activities were grouped into areas for further analysis as shown in Figure 1.

The different types of information required to support these activities were identified and nine information categories established. These information categories and their associated major systems were:

Accounting

General Accounting
Accounts Payable
Accounts Receivable
Grants and Contracts
Cost Sharing
Cash Receipts
*Student Loans

Purchasing

Supplies
Equipment
External Services
Internal Services

Inventory

*Facilities/Space
*Property
Rental/Use Scheduling
*Stores/Supplies
*Library Card Catalog
*Book Circulation

Project Management

*Time Reporting
*Project Control
Project Scheduling
*Work Order Billing
*Preventive Maintenance

Personnel

Position Control
*Personnel
*Payroll
Employee Benefits
Job Applicant Tracking
*Effort Certification

Management Information

Institutional Studies
Budgeting
Historical Records

Curriculum/Instruction

Course Catalog
Time Schedule
*Registration
Course Roster - Drop/Add
Grading
*Graduation

Student Services

*Admissions
*Advising
Transcripts
*Financial Aids
*Alumni/Development

Addresses

*Students/Alumni
*Employees
Vendors
*Customers
*Departments

*Currently integrated and operational in an on-line/data base environment.

UNIVERSITY ACTIVITIES

FIGURE 1

STUDENT SERVICES

- Recruitment
- Evaluation
- Testing
- Admission
- Honors Program
- Advanced Placement
- Financial Aid
- Student Loans
- Housing
- Meals
- Advising
- Registration
- Drop/Add
- Tutoring
- Grading
- Deficiencies
- Counseling
- Remedial Learning
- Discipline
- Student Records
- Status Changes
- To-Do Lists
- Graduation
- Honors Recognition
- Certification
- Transcripts
- News Events
- Activities
- Publications
- Information
- Benefits
  - Health
  - Veteran
- Auditing
- Reporting
- Statistics
- Compliance
- Safety
- Physically Impaired
- Exchange Programs
- Job Placement
  - Summer
  - Part-Time
  - Graduate

CURRICULUM INSTRUCTION

- Needs Assessment
- Design & Planning
- Justification
- Approval
- Scheduling
- Publications
- Instruction
- Evaluation
  - Program
  - Course
  - Instructor
- Joint Programs
- Accreditation
- Classes
  - Evening
  - Off-Campus
  - Correspondence

RESEARCH

- Identify Resources
- Support Sources
- Proposals
- Contracts
- Monitoring
- Cost Sharing
- Work
- Reporting
- Publications

PERSONNEL

- Recruitment
- Advertising
- Selection
- Hiring
- Assistantships
- Fellowships
- Development
- Sabbaticals
- Evaluation
- Promotions
- Certification
- Recognition
- Employee Relations
- Hearings
- Discipline
- Salaries/Wages
- Benefits
- Personnel Records
- Status Changes
- Terminations
- Retirees
- Assignments
- Effort Reporting
- Housing
- Publications
- Information
- Safety
- Auditing
- Reporting
- Statistics
- Compliance
- Affirmative Action

FINANCE

- Disbursement
- Collection
- Accounting Controls
- Auditing
- Money Management
- Fixed Assets
- Reporting
- Compliance
- Liabilities
- Financial Services
- Policies
- Procedures

FACILITIES

- Selection/Design
- Bids & Contracts
- Acquisition
- Construction
- Modification
- Alteration
- Maintenance
- Custodial Care
- Disposition
- Ownership
- Allocation
- Scheduling
- Security
- Inventory
- Rental

SUPPORT SERVICES

- Needs Assessment
- Evaluation
- Selection
- Bids & Contracts
- Purchasing
- Receiving
- Distribution
- Inventory
- Equipment Repair
- Equipment Rental
- Word Processing
- Forms Design
- Printing
- Graphics
- Duplicating
- Copy Centers
- Stores
- Utilities
- Garbage
- Telephone Service
- Testing Centers
- Laboratories
- Engineering Shops
- Computing Centers
- Ombudsman
- Legal Counsel
- Auditing
- Library
- Test Scoring
- Safety
- Transportation
- Animal Maintenance
- Laboratory Animals
- Vending Machines

UNIVERSITY RELATIONS

- Public Service
- News & Publicity
- Extension Programs
- Speeches/Lectures
- Reports/Papers
- Affiliations
- Negotiations
- Recitals & Concerts
- Theatre Productions
- Radio & TV
- Athletics
- Workshops
- Short Courses
- Conferences
- Conventions
- Community Education
- InterLibrary Loan
- HS Summer Camp
- Coliseum
- Calendar of Events
- Foreign Assistance
- Creamery
- Nursery School
- Veterinary Clinic
- WADDL
- Seed Testing
- Clinics
  - Comm. Disorders
  - Human Relations

UNIVERSITY DEVELOPMENT

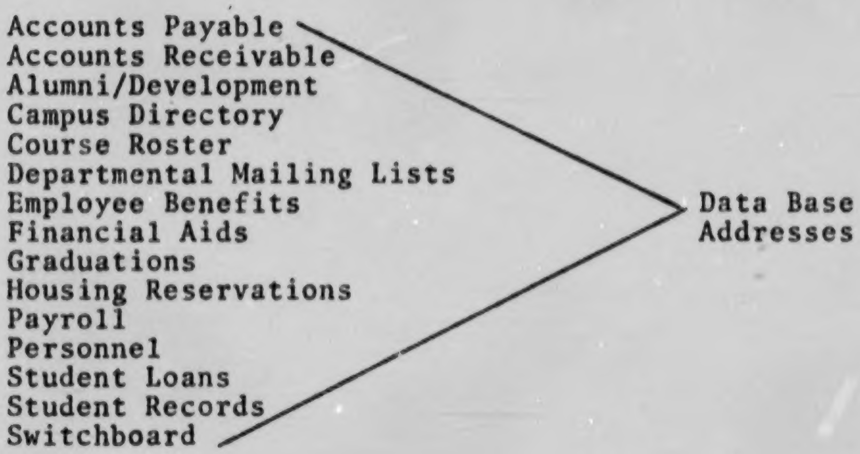
- Graduate Records
- Tracking
- Programs/Services
- Identify Needs
- Support Sources
- Donated Resources
- Publications
- Mailings
- Statistics

UNIVERSITY PLANNING

- Goals
- Objectives
- Budgeting
- Institutional Studies
  - Faculty Activities
  - Space Projections
  - Enrollment
- Comparative Studies
- Facilities Planning
- Modeling
- Simulation

It is important to emphasize that these information categories were not developed around the organization of the institution. They provide the data for activities, i.e., functions regardless of which unit performs the function. The data base approach supports the information requirements of the university as a whole.

Preliminary analysis revealed that names and addresses were maintained by nearly every system. Everyone maintained their own master file, whether automated or not, of address information. Duplications of information necessarily existed as well as duplicative procedures for keeping the addresses current. Names, addresses, and other common information from the following separately maintained master files were con solidated.



Accounts Payable
Accounts Receivable
Alumni/Development
Campus Directory
Course Roster
Departmental Mailing Lists
Employee Benefits
Financial Aids
Graduations
Housing Reservations
Payroll
Personnel
Student Loans
Student Records
Switchboard

Data Base
Addresses

The concept of maintaining one address record to be used by the entire university was strongly emphasized. The implementation of such a concept requires continued cooperation of everyone within the university.

The name and address file is the core or hub of the entire data base. Figure 2 is a representation of how this was accomplished with conversion of data from previous systems. Some of the other data elements that are maintained in the name and address file include:

- former name
- emergency contact
- birthdate/birthplace
- sex code
- ethnic origin
- military status
- visa type/expiration date
- citizenship
- children
- degrees earned
- contribution interests
- short course/seminar attendance

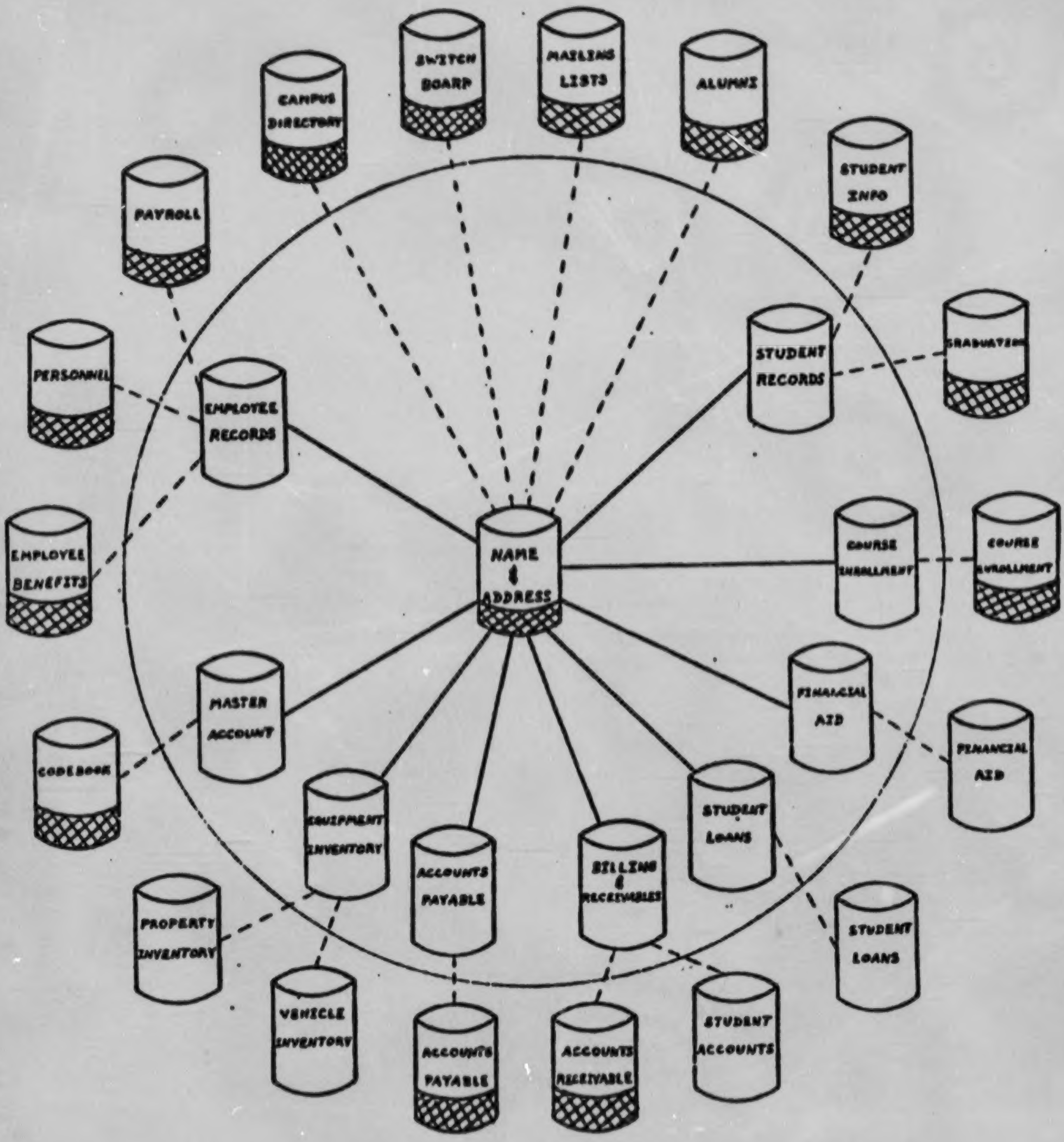

SWITCH BOARD
MAILING LISTS
ALUMNI
CAMPUS DIRECTORY
STUDENT INFO
PAYROLL
GRADUATION
PERSONNEL
EMPLOYEE RECORDS
STUDENT RECORDS
EMPLOYEE BENEFITS
NAME & ADDRESS
COURSE ENROLLMENT
COURSE ENROLLMENT
FINANCIAL AID
MASTER ACCOUNT
FINANCIAL AID
CODEBOOK
STUDENT LOANS
EQUIPMENT INVENTORY
ACCOUNTS PAYABLE
BILLING & RECEIVABLES
STUDENT LOANS
PROPERTY INVENTORY
VEHICLE INVENTORY
ACCOUNTS PAYABLE
ACCOUNTS RECEIVABLE
STUDENT ACCOUNTS

FIGURE 2: CONVERSION OF EXISTING SYSTEMS TO THE UNIVERSITY DATA BASE

(The hatched areas represent consolidated name and address)

Name and address information changes, as do most of the other data elements contained in the data base. A unique, never changing, identification number for each record in the name and address file was required to guarantee the integrity of the data base and its data relationships. The Payroll Office was using social security number. The Registrar's Office used a student number. The Alumni/Office their own man number. Campus mailing had department numbers. Employees had appointment numbers. And vendors had their own vendor numbers. One individual could be an employee, a student, an alumni, a customer, and also a vendor. Such a person had five different identification numbers in five separate systems. A universal numbering scheme was designed that would never change and be unique for each and every record in the name and address file. The multitude of previous numbering schemes were discontinued. The new number is used internally as a reference number between files. It is the "glue" which holds the data base together.

The unique and non-changing identifier is critical to the integrity of the data base. This does not mean, however, that information can only be obtained through the use of this unique number. Figure 3 presents the nine information categories and some of the key relationships that are defined. Access to information can be made through any known access point. The address record identification number provides the link to the name and address file for whatever common information is required. Information within the data base is related through common keys, e.g., the unique identifier.

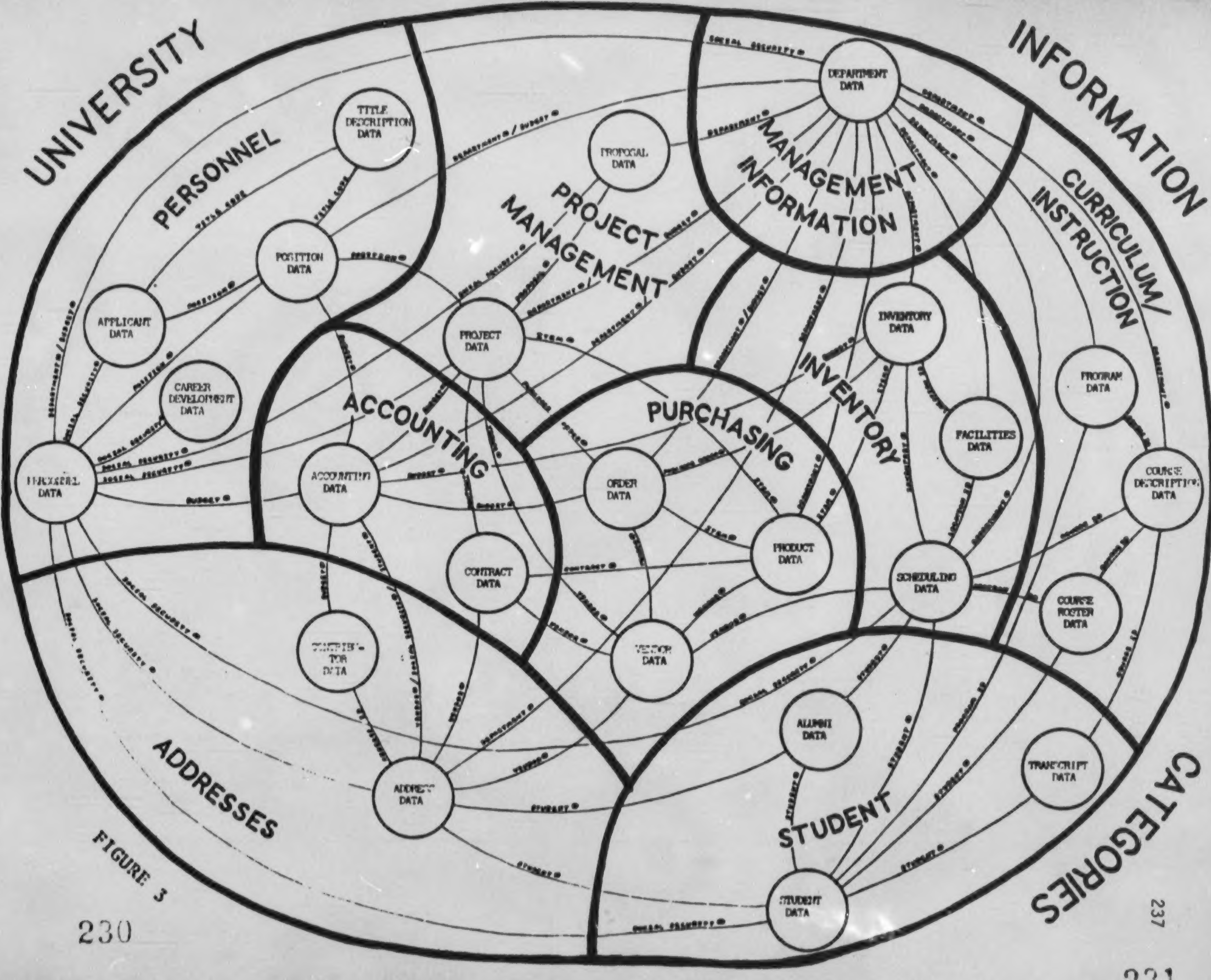

UNIVERSITY
INFORMATION
CATEGORIES
PERSONNEL
PROJECT MANAGEMENT
MANAGEMENT INFORMATION
CURRICULUM/ INSTRUCTION
ACCOUNTING
PURCHASING
INVENTORY
ADDRESSES
STUDENT
TITLE DESCRIPTION DATA
PROPOSAL DATA
DEPARTMENT DATA
POSITION DATA
APPLICANT DATA
CAREER DEVELOPMENT DATA
PERSONNEL DATA
PROJECT DATA
ACCOUNTING DATA
CONTRACT DATA
CONTRIBUTOR DATA
ADDRESS DATA
ORDER DATA
PRODUCT DATA
VENDOR DATA
INVENTORY DATA
FACILITIES DATA
SCHEDULING DATA
PROGRAM DATA
COURSE DESCRIPTION DATA
COURSE ROSTER DATA
ALUMNI DATA
TRANSCRIPT DATA
STUDENT DATA
SOCIAL SECURITY #
DEPARTMENT # / BUDGET #
DEPARTMENT #
POSITION #
TITLE CODE
BUDGET #
CONTRACT #
ITEM #
STUDENT #
COURSE ID

FIGURE 3

BENEFITS ACHIEVED

Significant progress has been made during the first two and a half years of the five year plan. In particular, the following progress has been made in each of the six problem areas.

1) Through the use of data base software we are experiencing the benefit of "program/data independence." Existing programs do not have to be recompiled or modified when new data elements are added to the data base unless a specific program uses the new element. New data elements can be added daily if warranted without impacting existing software. Through the use of data dictionary software we are building the documentation to identify the impact of requested changes. The size of the maintenance staff has remained at its reduced level.

2) Emphasis on the development of online systems has given the administrative offices a means to fix many of the data problems themselves without the involvement of others. Being online brings offices closer to their data and allows them to be more familiar with the workings of their systems. The involvement of our office in operational support of their systems is declining. Our Schedule and Control Group, which sets up and monitors batch work, is not growing in size as new systems are developed.

3) Creation of the central name and address file with one universal identification number is making it possible to relate personnel/payroll, student records, financial aid, student loans, accounts receivable, effort certification, and accounting transaction data. Several recent state agency requests for information, which crossed system boundaries, were easily answered from the data base.

4) A central address change office has recently been established so that there is one place to go to get a name/address updated. Once updated, all data base systems will have the new name/address. The staff in the many offices which previously maintained names and addresses are being reassigned to other tasks.

Elimination of redundant versions of the same information in the data base has revealed some of the inconsistencies which have plagued university record keeping. For instance, about 60 employees in the personnel system had a different social security number from the one used in the payroll system. Originally about 25% of the account coding in the personnel system agreed with the coding in payroll. This has been improved through shared data base files to over 70%. Over 60% of the employees also had student identification numbers and 10% of the accounts receivable (non-students) were also employees. About 100 people in the payroll system were still in the student records system under former or maiden names. Cleaning up the inconsistencies is not complete and it has not been without some trauma. Some offices have been slow to accept the concept of shared files/data.

5) Implementation of online systems in "data feeder" units on campus is raising the productivity of the staff in these units while reducing the need for large central staffing.

As an example, Figure 4 compares the process of placing an order for supplies under a batch/manual approach verses the on-line/data base approach. The on-line process is obviously simpler and eliminates many labor intensive steps previously required. In addition, the individual placing the order knows imme-

BATCH/MANUAL APPROACH	DATA BASE APPROACH
Required Equipment & Supplies	Required Equipment & Supplies
Typewriter Typewriter Supplies Requisition Forms (multiple copies)	CRT Terminal Packing Slips (multiple copies)
Type Requisition	Enter Order
Deliver Requisition to Central Stores	
Fill the Order	Fill the Order
Process Paperwork at Central Stores	
Deliver Paperwork to Accounts Payable	
Process Paperwork at Accounts Payable	
Keypunch Account Transactions	
Setup Batch Run with Keypunched Data	
Process Accounting Transactions	Process Accounting Transactio
Deliver Batch Output	

FIGURE 4: PLACING AN ORDER FOR SUPPLIES

diately if the quantity requested is available or the item must be back-ordered, receives an immediate extended price for each item as well as the total cost of the entire order, and knows the balance of the account. A packing slip is printed for the supplier when the order is completed, which identifies the individual and associated department that placed the order. The accounting has taken place and the transfer of funds is done completely through the data base.

Another example is the use of the data base as an online Library catalog. The data base can be queried by author, title, key word, subject, as well as other access points to obtain information about library materials. Once an appropriate item is found, the individual can determine which branch libraries have copies of the item, which copies are out and when they will be returned, and can place themselves on the wait list for the next available copy. The individual could check the book out to themselves and, when the delivery problem is solved, have the book delivered to their home/office. All this can be done from any terminal on campus.

6) During the first half of the five year plan, nine major new systems have been implemented; financial aid, stores/supplies inventory, personnel/payroll, effort certification, project/work order management, library catalog and circulation, alumni/development, property inventory, and student loans. In addition, the old student records and facilities inventory systems were converted to use the data base and share information with the new systems. The remaining half of the plan includes finishing the personnel/payroll and effort certification systems, and implementing data base versions of position control/budgeting, accounts receivable, purchasing, accounts payable, and accounting. With the new systems, Washington State University is in a good position to remain compliant with State and Federal mandates.

CONCLUSION

The benefits of an integrated online data base approach are real. The two years of experience at Washington State University have convinced us that it is possible to significantly increase the productivity of administrative staff and lower the overall cost of university administration while improving the quality of record keeping and the accuracy of reports. Two observations are noteworthy, however.

First, converting 15 years worth of past programming is expensive and time consuming. If the systems are not redesigned to use data base concepts, they will have a higher operating cost after the conversion than before. Purchased software, which is not redesigned and reprogrammed to use data base concepts, will also have higher operating costs. Software development is expensive. The decision to invest in the data base approach is a long term one.

Second, the use of a central data base has major implications for the distribution of administrative funds. In all likelihood, computing costs will increase and staff costs will decrease with a lower net cost for university administration. Office budgets will not be impacted uniformly. One office may be able to function with only half as many staff while another office which is a "data feeder" may face an increased staff load. Whatever the distribution of costs, the higher the percentage in online computing, the lower the impact of inflation on administrative budgets. A data base must be managed from the top of the organization if resources are going to be redistributed.

The transition from an environment of separate files "owned" by individual offices to a shared data base which "belongs" to the whole university will be met by some resistance. It takes cooperation and understanding on everyone's part. Cleaning up and straightening out all of the inconsistencies, which develop when systems are designed independently, takes patience and commitment to the end goal.

Washington State University is not through developing its data base. It is halfway through development of new data base software. The added costs of new development, in addition to ongoing operating costs, have stretched shrinking budgets to their limits during these poor economic times. Enough is known now to confirm the validity of the concept. We remain optimistic that the University will recognize the long term benefit of this approach to the whole University, and continue its investment even during these hard times.

WORD PROCESSING AT CARNEGIE-MELLON UNIVERSITY

Joyce A. Wineland
Manager of Student Systems
Carnegie-Mellon University
Pittsburgh, PA 15213
December 3, 1981

Word processing is the use of a computer to enhance human-to-human communication. Carnegie-Mellon University (C-MU) is becoming deeply involved in Word Processing in several modes.

Traditional means of communication include: talking face-to-face, telephone, friendly notes, interoffice memos, formal letters. Each has advantages and disadvantages of formality, ease of exchange of ideas, availability of both parties, keeping a copy, making changes, and cost. The same factors apply to the various Word Processing modes that C-MU uses.

Word Processing at C-MU includes: Dedicated Word Processing system, Word Processing package on a general-purpose mini-computer, Computer Mail, Text Editor, Text Formatter, Speller, Xerox 9700 Laser Printer.

This paper will discuss each of the above modes of Word Processing at C-MU and illustrate how some of the departments are using them to enhance their communication.

WORD PROCESSING AT CARNEGIE-MELLON UNIVERSITY

by
Joyce A. Wineland

INTRODUCTION

Carnegie-Mellon University

Carnegie-Mellon University (C-MU) is a small private, co-educational university in Pittsburgh, PA. C-MU is particularly strong in Engineering, Computer Science, Fine Arts, and Management Sciences. Its best known current projects are Artificial Intelligence and the Robotics Institute, which is in conjunction with industry and some government agencies.

C-MU began in 1900 when Andrew Carnegie founded the Carnegie Institute of Technology (known as Carnegie Tech). In 1967 it merged with Mellon Institute which is located a few blocks away, to form Carnegie-Mellon University. The University is now comprised of 6 colleges and 25 academic departments with a student body of 5600 students of which 3800 are undergraduates and 1800 are graduate students.

Most computers at C-MU are manufactured by Digital Equipment Corporation (DEC). The central university facility is known as the Computation Center. The Computer Science Department also has a large facility and many other departments have computers of their own.

The Computation Center has 5 DECSYSTEM 20s and 2 PDP-11s, and 1 VAX. All are linked together by DECNET. There are line printers, but most printing is done on a Xerox 9700 laser printer. Other equipment includes a Calcomp plotter and a Dunn Camera and GIGI color graphics terminals.

The Computer Science Department has 1 DECSYSTEM-20, 2 DECSYSTEM-10s, and dozens of PDP-11s, and 11 VAX computers. In addition, they have 10 Xerox Altos, 20 Perqs which are made by Three Rivers Computer Corporation, and a home-grown computer named Cm* which is built from 50 LSI-11s. Their main printer is a Xerox Dover.

Word Processing

Word Processing is the use of a computer to enhance human-to-human communications. Carnegie-Mellon University is becoming deeply involved in Word Processing in several modes.

Traditional means of communication include: talking face-to-face, telephone, friendly notes, interoffice memos, and formal letters. Each has advantages and disadvantages regarding formality, ease of exchange of ideas, making changes, and cost. The same factors apply to the various Word Processing modes that C-MU uses.

Word Processing at C-MU includes:

1. Dedicated Word Processing System (WS200)
2. Word Processing Package on a General-Purpose Mini-computer (WORD11)
3. Computer Mail (MS)
4. Text Editor (EMACS)
5. Text Formatter (SCRIBE)
6. Spelling Checker (SPELL)
7. Programmable Printer (Xerox 9700)

This paper will discuss each of the above modes of Word Processing at C-MU and will illustrate how some of the administrative offices are using them to enhance their communication.

FACTORS AFFECTING CHOICE OF MODE OF COMMUNICATION

Before discussing the various Word Processing techniques that are used at C-MU I want to make a few comments about several factors that affect the mode of communication that a person would use for a certain message.

- Cost/Effective - Dollar cost is not a good indicator of value. Cost/effective evaluations are more precise. In general, person-to-person and local telephone conversations are the least expensive. Individual typed letters are low-cost also. Despite the initial cost of the computer, using computerized list processing could be the most cost/effective means of communication.
- Interactive vs One-way - A drawback of person-to-person or telephone conversations is the requirement that both parties be available at the same time.

However, for discussion, exchange of ideas, or expression of emotion conversation is the best means of communication.

- Formality - Compare a note to a friend with an official contract. A note written by hand on 6" x 8" tinted paper signifies a different attitude than a contract typed on 8 1/2" x 14" white paper with bold headings and fine print, plus an official insignia in a corner.

- Ease of Corrections - When talking, if you make a mistake, you can immediately apologize and correct yourself. A typed document can have a character corrected fairly easily, but larger changes require tedious retyping of the entire document. A document on a computer, however, can easily be changed, no matter what the size of the change, and a new copy can be printed with little effort.

- Record-keeping - Conversations are not usually recorded. Typed information can be filed in a cabinet, but computerized documents can be kept on disk or on tape taking much less physical space.

- Making Copies - There are 2 kinds of copies to discuss here: Identical and Personalized. Photocopying is the usual means of making identical copies of a written document, and is quick and easy. Typing individual personalized letters takes a lot of time and effort, however computerized list processing techniques make it quick and easy.

- Visual vs. Audio - As much as 80% of the content of a face-to-face interaction is derived from non-verbal clues. Vocal inflections and body language express more than the words could ever say. Also, handwriting displays much of the writer's attitude. However, when only the facts should be expressed, typing or word processing are more effective.

WORD PROCESSING MODES AT C-MU

At Carnegie-Mellon University, there are many computer procedures available to enhance communication among people. All of the DECSYSTEM-20s on campus have Computer Mail, text editors, text formatters, spelling checkers. One DEC PDP-11 in the Computation Center has the word processing package, WORD-11. The DEC WS-200, in the administration building, is a hardware/software combination that is dedicated to word processing. The Xerox 9700 laser printer is programmable, such that a user can write a program to describe a special form which it will print at the same time as it prints the data on it. Word Processing is integrated with the master files on the DECSYSTEM-20 because the names and addresses and other personal information which is needed for List Processing comes from the master files.

The five DECSYSTEM-20s and two PDP-11s and the VAX are on a DECNET local network so files can be shipped from one to the other with ease. The WS200 also has a link with the DECSYSTEM-20 that the administrative offices use. The X9700 is not connected directly to any of the computers, so output files are spooled to tape and carried to the Xerox 9700 for printing.

The WS200 and WORD-11 output documents normally are printed on a Xerox 630 Diablo-type character printer. This is a high-quality impact printer but is comparatively slow.

The documents from the DECSYSTEM-20 are normally printed on the Xerox 9700 laser printer, though line printers and Diablo-type printers also are available.

WS200

In the administration building, there is a dedicated word processor, the WS200. It is a DEC product and currently has 8 terminals and 3 printers attached. Files are saved on either hard or floppy disks. The system is considered stand-alone, though there is a link with a DECSYSTEM-20. The WS200 is a very good document preparation device because it is easy to learn and to use: it is menu-driven. Editing commands are identified on the keyboard. Uppercase/lowercase, boldface, and underlining can each be accomplished with a couple of keystrokes.

The WS200 also has list processing. List processing is the technique of entering a letter with tags in the positions of name, address, and other personal information. Another file contains the names, addresses, and other personal information each beside the same tags. It also uses a third file containing specifications that can be used to modify the list processing activity. The list processor is then run using the letter, the list of names, and the specifications to yield the personalized letters. The letters are then printed on a Diablo printer and the task is complete. The list of names, etc. can be used for many different letters, documents, labels, etc. so it is really a Master File. That is why the specifications are needed - to select only the people needed.

The greatest advantage of the WS200 is that it is very fast. It is also easy to learn and to use. It produces letter-quality documents that look like they were typed specifically for the recipient.

The major disadvantage of the WS200 is its stand-alone nature. We do have ability to ship to or from our mainframe, but it is not as easy as the DECNET link. Also, it can't be used as a general-purpose computer. Printing is slow because it is done character by character with a Diablo, so large documents or multitudes of personalized letters take many hours. Because of configuration limitations, it is available only to eight people in the administration building who share the cost of operating the computer and printers.

WORD-11

The Word Processing system that we are now moving towards is WORD-11. WORD-11 was developed by a private company, though DEC has just bought the rights to market it. WORD-11 has List Processing, but also has a spelling checker and sorting and some arithmetic.

To use the spelling error detector, the document is entered, the speller is run and the results are printed. The results can be either the document with errors underlined or just a list of all misspelled words. A basic dictionary of 10,000 words is provided with the system but the users have the option of creating special dictionaries for special subjects or adding to the system dictionary.

The advantages that WORD-11 has over the WS200 are numerous. The costs are lower, but has more features. It can handle numerous users anywhere on campus. It uses a general-purpose computer. It is on the network with other computers so one physical terminal can access any computer and anyone can ship files to use features available on other computers.

The only major disadvantage is that since it is on a timesharing system, response time is not as good.

Computer Mail

Computer Mail is probably the most used Word Processing mode of communication at C-MU in terms of number of different messages sent. Though most computers have a mail system, the one on the DECSYSTEM-20s (MS) is the most flexible. MS is used every day in many departments and is my most frequent means of communication with my Director.

While writing a message, corrections can be made using the regular file editor, usually EMACS, and identical copies can be sent to any number of people. It is quick and the recipient does not need to be logged in to the computer to be able to receive the mail. It is stored there until he next logs in. Because all of the DECSYSTEM-20s are on DECNET and MS supports local networking, messages can be sent to anyone on any computer. Identical copies can be sent to many people and it is easy to reply to messages from other people, as well as to forward messages to a third person. Messages may also be encrypted for security. A user can print messages sent and received, or get a summary of message headers.

C-MU also has a DECNET link with Columbia University in New York. Each university pays half the costs for the network. The major use of this network is for mail messages between the universities.

Computer mail is terrific for short messages to a colleague who is also a frequent user of the computer.

Computer mail, however is less efficient for very long messages with many items that must be acted upon or that require discussion. It also tends to be informal.

EMACS

A simple procedure of entering information into a file which can either be printed on paper to give to the recipient or sent to his UserID where he can read it is also word processing. At C-MU, we enter the information into a file using an editor called EMACS which was developed at MIT. It is a "screen editor" which means a screen-full of information is on the CRT at all times. It tries to keep the line we are working on in the middle of the screen, (which is different from WS200 and WORD-11 which keep the line we are working on at the bottom of the screen). The operator moves around within the document, deletes characters and performs other editing functions by holding the the CONTROL key while hitting another key to perform that function.

The document can be printed on any printer.

If hard-copy (printed) is not required and recipient's UserID is accessible on a computer, the document can be copied to his UserID, merged into an MS message, or a message sent to him (using MS) telling him how to get it from the sender's UserID. Identical copies of the file can be sent to any number of people.

The advantages of EMACS compared to WORD-11 or the WS-200 are: it is on all of the DECSYSTEM-20s, it is much more flexible, it is programmable, it has its own speller.

The disadvantages are: it is more difficult to learn and to use because it is more flexible, it cannot boldface and underline, there is no List Processing on any DECSYSTEM-20.

SCRIBE

SCRIBE is a system developed by a C-MU graduate student for DECSYSTEM-20 and is now sold by a private company. The user must enter his message into a file then insert the commands that SCRIBE will use to format the output. He then runs the file through the SCRIBE program and the result is another file that, when printed, looks the way he specified.

Some of the formatting that SCRIBE can provide are: justified right margins, special print fonts, numbering of items in a list, Greek characters, mathematical symbols, title page, bibliography, footnotes and index. If the user tells SCRIBE what kind of document he is writing it will set up certain default assumptions. For example, "Text" is the simplest document type so the only actions defaulted are right-justified margins and page numbering. But a "Manual" is one of the most complex and has Chapter, Section, Subsection, Paragraph, Appendix, Appendix Section, and Index features.

SCRIBE has different capabilities for different output devices. If a command is used that cannot be accomplished on the device requested, SCRIBE will convert it to something similar that can be handled or will ignore the command. Some devices are the line printer, Diablo, Xerox 9700, and GIGI terminal.

C-MU has also added some special features to SCRIBE to take advantage of even more features of the Xerox 9700. Two SCRIBE features that are particularly useful to administrators are "Letterhead" and "Memo". Each of them has the letterhead "Carnegie-Mellon University" printed a distinctive font. The Letterhead also has the return address in a small font to mimic letterhead paper while the rest of the letter is generated using the normal SCRIBE procedures. The Memo form has "Carnegie-Mellon University" at the top in the special font; then To:, From:, Date, and Subject: in boldface aligned underneath it; with a wide dark line across the page to separate the heading from the text. The names of the people To: and From: and the actual date and subject of the memo are all in the normal font, as is the body of the memo.

The advantages of SCRIBE are tremendous and when used with Xerox 9700 are even greater. It has wide flexibility for formatting reports, letters, memos, and books, and since the general layout of each is already defined as a special form many defaults are preset, making it much easier to use. The various print fonts give the results a professional appearance.

The disadvantages of SCRIBE compared with the specialized word processors are that it requires more user sophistication because the user must also know EMACS in order to enter the document and the SCRIBE commands, and that a separate pass must be made to convert the file with the SCRIBE commands into the printable file.

Spell

Spell is a program which was developed at Stanford and runs on the DECSYSTEM-20s. It compares the words in a document with the words in a dictionary. The basic dictionary contains over 40,000 words but auxiliary dictionaries can also be used which are created by the user. Spell strips off prefixes and/or suffixes to find the root word. Its outputs are a file of the original document with all of the spelling corrections, a file of the misspellings it found along with the corrections made, plus an optional file of all the words the user added to the dictionary.

Xerox 9700 Laser Printer

The Xerox 9700 Laser Printer is a device that has some programming capabilities that enhance its printing expertise. It prints 2 pages/second, either landscape (horizontal) or portrait (vertical). The printing is black, but the paper can be any color or any weight from onionskin to cardboard. We are adding an option to allow it to print on both sides of the paper. The programming capabilities were originally intended to make special forms of the kind that a user usually has a print shop produce on continuous forms paper so the line printer can fill in the data. When using a Xerox 9700 special form, however, the form and the data are both printed on the blank paper at the same time.

A special form usually begins on a DECSYSTEM-20 as a file which contains the form written in the Xerox 9700 Forms Description Language. The file is written to a tape which is then carried to the Xerox 9700 which reads it and compiles it into a form and prints a sample. If there are any errors, the changes are made on the file on the DECSYSTEM-20 and the process is repeated. When the form is correct it is stored on the Xerox 9700. At any time thereafter, data can be printed on paper with this form.

When writing a form that will be a word processing-type letter, the basic letter must be created very carefully so that the proper amount of space is allowed for the personal information that will be plugged in. This printer does not have the ability to close up extra blank lines or characters which may occur because of different numbers of lines in the address or number of characters in a piece of personal information. The letter form does have the ability of producing the letterhead "Carnegie-Mellon University" in a special print font and the return address in a small font. Also the signature of the writer can be digitized, so the letters are also "signed" at the time of printing.

The advantages of the Xerox 9700 Laser Printer are its many print fonts, speed of printing, and ability to draw lines and signatures.

The disadvantages compared to the WS200 or WORD-11 are the lack of real list processing, greater time to create the form, and need to also know EMACS to create the form.

EXAMPLES

There are many examples of Word Processing at Carnegie-Mellon University, but I will discuss only a few of the more dramatic ones here.

ADMISSIONS OFFICE

The Admissions Office is one example of how an administrative office chooses from the Word Processing modes which are available depending on the requirements of each task. Two different list processing-type letters that the Admissions Office uses are letters to Guidance Counselors and letters to students acknowledging receipt of their admission deposit. The Guidance Counselor letters are processed on the WS200 because there is a limited number of them and because the Admissions office wants the Counselors to think they received a personal letter. The receipt, however, is done with a Xerox 9700 form because several thousands are needed, less variable information is printed on each, and the signature is also printed on the letter.

Public Relations

The Public Relations Department is using WORD-11 extensively for News Releases and other Publicity items. Their productivity is greatly increased over previous levels when secretaries typed everything. They had spent a great deal of time retyping an article when corrections or revisions were made. Now the author himself can make the corrections without retyping the whole item and the project can be completed in much less elapsed time. The PR department uses a special letterhead paper in their Diablo printer for the News Releases and for the letters to the hometown newspapers of students, both of which are done by WORD-11.

ACM Newsletter

I am Secretary of the Pittsburgh Chapter of the Association of Computing Machinery (ACM) and one of my staff is the ACM newsletter Editor. C-MU has been gracious enough to allow us to keep the Membership system on a DECSYSTEM-20 and to use SCRIBE to produce the Newsletter and other support items. The newsletter is a professional-looking document with its heading in large print and a double-column format. It also uses a medium-size font for section headings with italics and underlining where appropriate. The only part it cannot yet do is the map of the meeting location.

This Paper

This paper was produced with the help of EMACS, SCRIBE, SPELL, and the Xerox 9700 printer. The secretary entered the bulk of the text from my notes into the computer and I made changes to it and inserted SCRIBE commands using EMACS. I ran the text through Spell to check my spelling then through SCRIBE to convert the commands into Xerox 9700 print format. I made improvements to the text and to the SCRIBE commands and ran it through SCRIBE and printed the results many times until I was satisfied with the result.

CONCLUSION

Because C-MU wants to be known as one of the country's leading universities, it must not only give the highest-quality education and conduct imaginative research, but must also present an attractive, professional image. One of the ways it does that is by sharp-looking personalized letters and well-written books, articles, and speeches. Word processing makes all of these easier and faster.

Carnegie-Mellon University has many Word Processing modes available to its community. Each enhances human-to-human communication in a different way, so for any one item, all of the factors in communication must be weighed before choosing the method that will best fit its purpose.

A short message to someone who also uses the computer frequently may best be conveyed through computer mail.

People who are not familiar with a computer who are working on an article that will need many revisions would have best results with WORD-11 or the WS-200.

Personalized letters to a few hundred people or less also are easiest on WORD-11 or the WS-200.

But if someone needs to do thousands and has the extra time to carefully lay out the letter and the spaces for the personal information, he may find it more cost/effective to create a Xerox 9700 form for the letter.

An item that requires discussion and for which information is needed quickly, a phone call or conversation in person is likely the most effective way to handle it.

Although some people still think they will break the computer as soon as they touch a terminal, reactions have been favorable. As each academic department and administrative office sees positive results from others who are using Word Processing, they besiege the Computation Center with requests for UserIDs, equipment, and training. Because they are eager to use it, people learn quickly. Computer terminals are now a normal office fixture. The Admissions Office found that Word Processing made their letters faster and easier than typing, and it contributed to the recruiting of the largest Freshman class ever. I myself average 50 computer mail messages per week, sending and receiving, communicating with my staff, my boss, and other people on campus.

The future of Word Processing is bright. My department, Administrative Systems, is now developing campus-wide Word Processing and Office Automation procedures. Every office will have terminals with access to any of our computers and all of the computers are on a network so that information can be processed on the computer which has the needed capabilities. The Public Relations department dreams of being able to send stories directly from our computers to the computers of major newspapers. They also want the biographies of researchers to be on-line so that they can pull them into any story about their work. Students will send their homework and reports directly to the UserID of their professors.

The future of Word Processing at C-MU is limited only by the imagination of its users.

Carnegie-Mellon University

5000 Forbes Ave.
Pittsburgh, PA 15213

November 23, 1981

CAUSE
737 Twenty-Ninth Street
Boulder, CO 80303

Dear Sir:

Enclosed are 2 Abstracts of possible papers for the CAUSE 81 Conference. These are projects that I have been involved with at Carnegie-Mellon University. I hope that you will find at least one of them worthy of presentation.

Sincerely,

Joyce A. Wineland

Example: Scribe Letterhead

ASSOCIATION FOR COMPUTING MACHINERY

PITTSBURGH CHAPTER **DECEMBER, 1981**

December Meeting

DATE: Wednesday, December 9, 1981

LOCATION: Carnegie-Mellon University
Skibo Hall, Room 100

TIME: Social Hour 5:30 PM
Dinner 6:30 PM
Meeting 7:30 PM

TOPIC: Robotics at CMU and their Coordination

When you think of Robotics, do you envision metal monsters as in *The Day the Earth Stood Still* or perhaps as being highly intelligent beings as in *The Questor Tapes.*

Whatever your thoughts, you don't want to miss this next meeting. As technology continues to advance, and the demand for higher quality control continues to increase, it is clear that Robotics will play an important role in Industry.

Recently a concentrated effort has been made toward the study of Robotics at Carnegie-Mellon University. Our speaker will provide us with an overview of Robotics at C-CMU along with familiarizing us with it's various components. We will examine the sub-components of what makes up a robot, 2D and 3D vision, and the various types of robots; walking and otherwise.

Finally we will look at the use of robotics to perform complex tasks in a manufacturing environment. The method of coordinating various robots to perform a unified task will be presented along with a description of the network technique used.

REMEMBERING LAST MONTH

Last month's speaker, Mr. David Black, provided us with a description of program generators and their underlying theroey. We examined his Cobol Program generator which can generate programs to handle most applications with very little/easy modification, and in a specified style of coding.

SPEAKER: Dr. David Bourne

Dave Bourne is a Research Associate with the Robotics Department at Carnegie-Mellon University. He holds a BS in Mathematics from the University of Vermont and a Phd in Computer Science from the University of Pennsylvainia. Having been with C-MU for the past 14 months, he is especially involved with Artifical Intelligence and Computer Vision.

RESERVATIONS

Reservations can be made by contacting Joy Ott at On-Line Systems (931-7600) before 4:45 P.M. Monday, December 7. Although a reservation is not required for the meeting portion of the evening, attendees are encouraged to call and advise if they are planning to attend the meeting. This may have a bearing on the room we are assigned at Skibo Hall.

If you make a reservation please show up or find a substitute to take your place, as we are charged for each meal reserved.

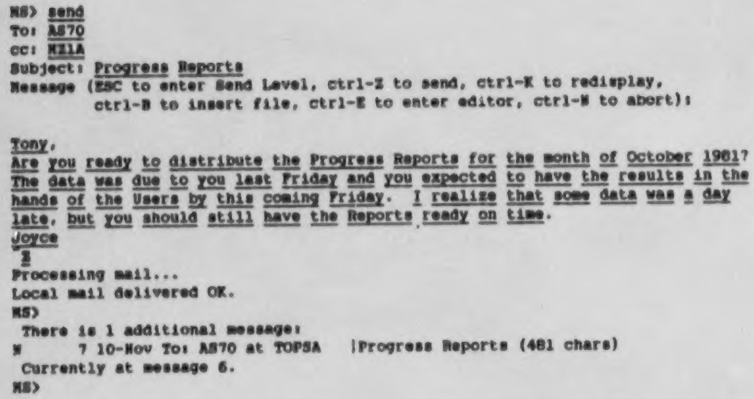
DINNER ENTREE: Roast Fresh Ham with
Dressing, Gravy

COST: Members $9.50
Non-members $10.50

Remember, the costs associated with attendance at professional meetings are tax deductible or, depending on your employer's policies, may be reimbursable.

MAP OF MEETING LOCATION

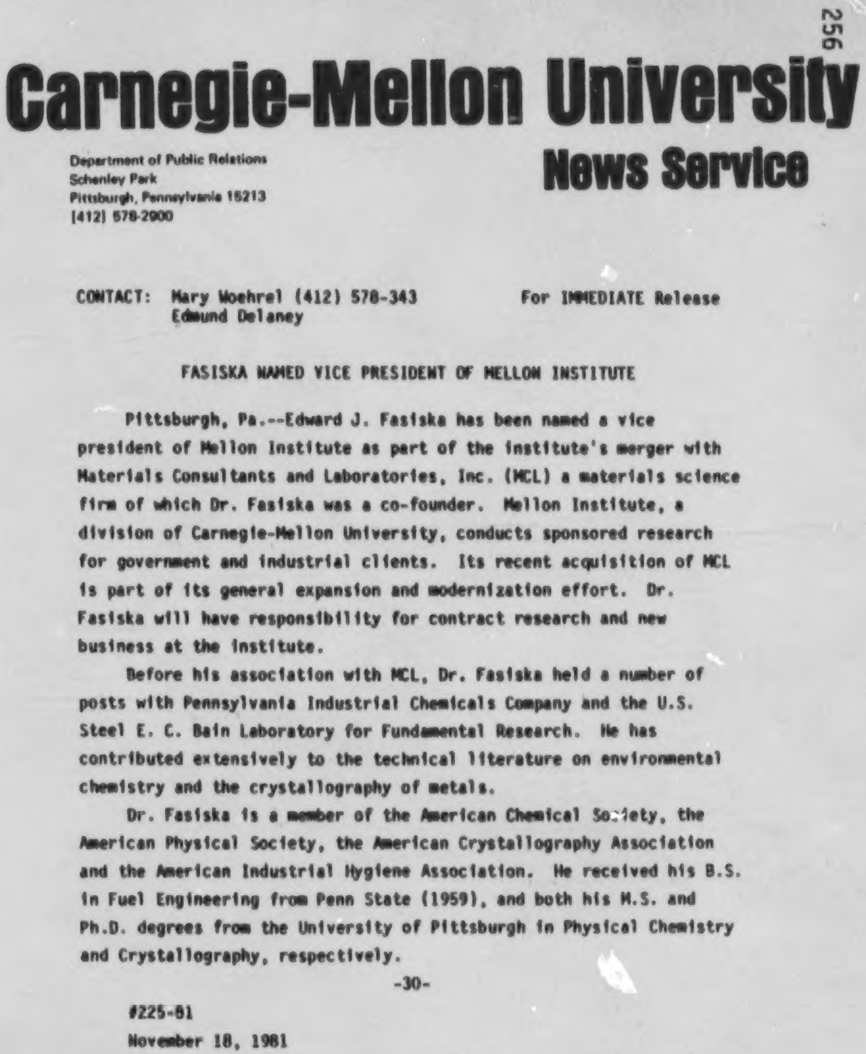
Example: ACM Newsletter - created in EMACS, checked be SPELL, formatted by SCRIBE,
printed on Xerox 9700



```
MS> send
To: AS70
cc: MZ1A
Subject: Progress Reports
Message (ESC to enter Send Level, ctrl-Z to send, ctrl-K to redisplay,
        ctrl-B to insert file, ctrl-E to enter editor, ctrl-N to abort):

Tony,
Are you ready to distribute the Progress Reports for the month of October 1981?
The data was due to you last Friday and you expected to have the results in the
hands of the Users by this coming Friday.  I realize that some data was a day
late, but you should still have the Reports ready on time.
Joyce
^Z
Processing mail...
Local mail delivered OK.
MS>
 There is 1 additional message:
N      7 10-Nov To: AS70 at TOPSA   |Progress Reports (481 chars)
 Currently at message 6.
MS>
```

Example: Sending Computer Mail



Carnegie-Mellon University

News Service

Department of Public Relations
Schenley Park
Pittsburgh, Pennsylvania 15213
(412) 578-2900

CONTACT: Mary Woehrel (412) 578-343 For IMMEDIATE Release
Edmund Delaney

FASISKA NAMED VICE PRESIDENT OF MELLON INSTITUTE

Pittsburgh, Pa.--Edward J. Fasiska has been named a vice president of Mellon Institute as part of the institute's merger with Materials Consultants and Laboratories, Inc. (MCL) a materials science firm of which Dr. Fasiska was a co-founder. Mellon Institute, a division of Carnegie-Mellon University, conducts sponsored research for government and industrial clients. Its recent acquisition of MCL is part of its general expansion and modernization effort. Dr. Fasiska will have responsibility for contract research and new business at the institute.

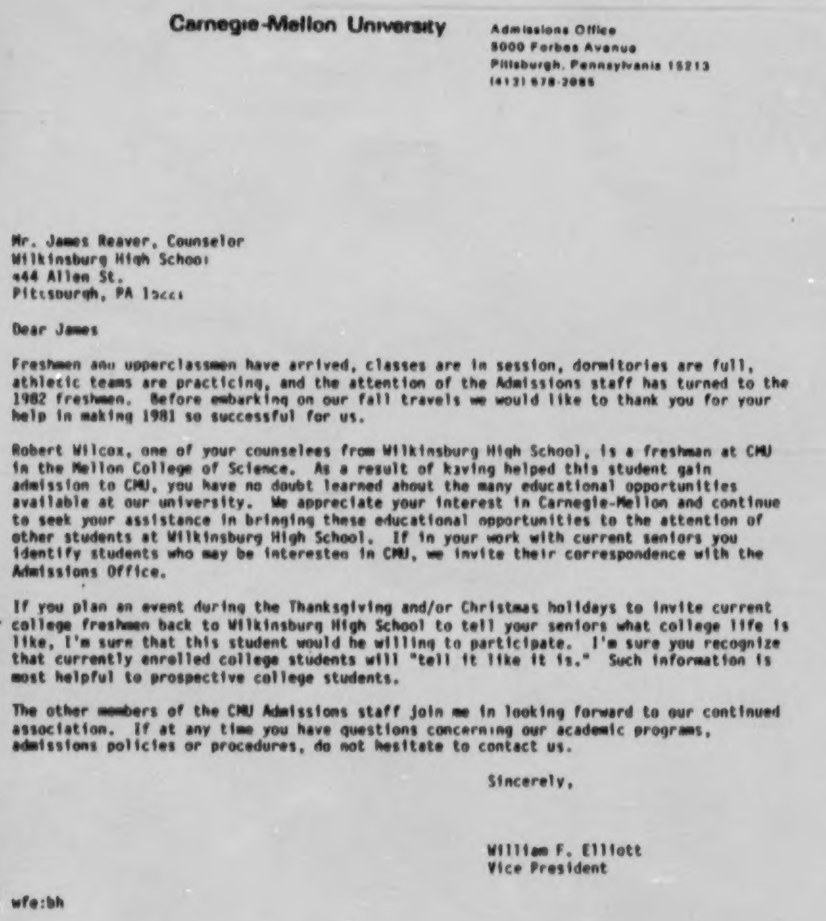
Before his association with MCL, Dr. Fasiska held a number of posts with Pennsylvania Industrial Chemicals Company and the U.S. Steel E. C. Bain Laboratory for Fundamental Research. He has contributed extensively to the technical literature on environmental chemistry and the crystallography of metals.

Dr. Fasiska is a member of the American Chemical Society, the American Physical Society, the American Crystallography Association and the American Industrial Hygiene Association. He received his B.S. in Fuel Engineering from Penn State (1959), and both his M.S. and Ph.D. degrees from the University of Pittsburgh in Physical Chemistry and Crystallography, respectively.

-30-

#225-81
November 18, 1981

Example: Public Relations News Release from WORD-11



Carnegie-Mellon University

Admissions Office
5000 Forbes Avenue
Pittsburgh, Pennsylvania 15213
(412) 578-2085

Mr. James Reaver, Counselor
Wilkinsburg High Schoo:
444 Allen St.
Pittsburgh, PA 1[illegible]

Dear James

Freshmen anu upperclassmen have arrived, classes are in session, dormitories are full, athletic teams are practicing, and the attention of the Admissions staff has turned to the 1982 freshmen. Before embarking on our fall travels we would like to thank you for your help in making 1981 so successful for us.

Robert Wilcox, one of your counselees from Wilkinsburg High School, is a freshman at CMU in the Mellon College of Science. As a result of kaving helped this student gain admission to CMU, you have no doubt learned ahout the many educational opportunities available at our university. We appreciate your interest in Carnegie-Mellon and continue to seek your assistance in bringing these educational opportunities to the attention of other students at Wilkinsburg High School. If in your work with current seniors you identify students who may be interesten in CMU, we invite their correspondence with the Admissions Office.

If you plan an event during the Thanksgiving and/or Christmas holidays to invite current college freshmen back to Wilkinsburg High School to tell your seniors what college life is like, I'm sure that this student would he willing to participate. I'm sure you recognize that currently enrolled college students will "tell it like it is." Such information is most helpful to prospective college students.

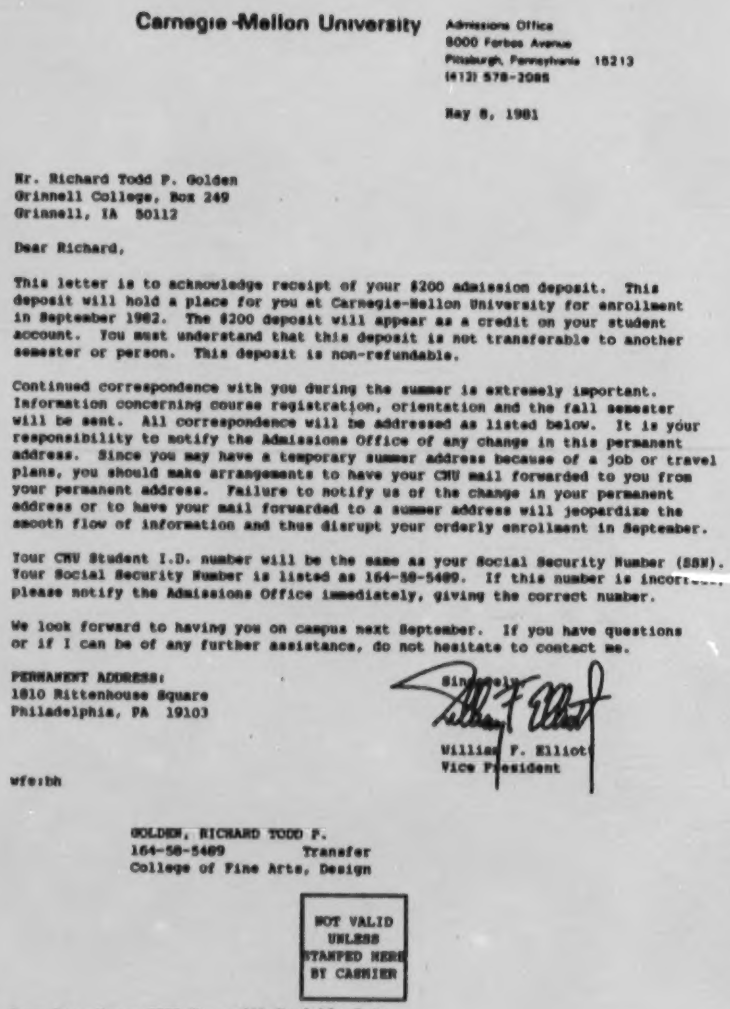
The other members of the CMU Admissions staff join me in looking forward to our continued association. If at any time you have questions concerning our academic programs, admissions policies or procedures, do not hesitate to contact us.

Sincerely,

William F. Elliott
Vice President

wfe:bh

Example: List Processing from WS200



Carnegie-Mellon University

Admissions Office
5000 Forbes Avenue
Pittsburgh, Pennsylvania 15213
(412) 578-2085

May 8, 1981

Mr. Richard Todd P. Golden
Grinnell College, Box 249
Grinnell, IA 50112

Dear Richard,

This letter is to acknowledge receipt of your $200 admission deposit. This deposit will hold a place for you at Carnegie-Mellon University for enrollment in September 1982. The $200 deposit will appear as a credit on your student account. You must understand that this deposit is not transferable to another semester or person. This deposit is non-refundable.

Continued correspondence with you during the summer is extremely important. Information concerning course registration, orientation and the fall semester will be sent. All correspondence will be addressed as listed below. It is your responsibility to notify the Admissions Office of any change in this permanent address. Since you may have a temporary summer address because of a job or travel plans, you should make arrangements to have your CMU mail forwarded to you from your permanent address. Failure to notify us of the change in your permanent address or to have your mail forwarded to a summer address will jeopardize the smooth flow of information and thus disrupt your orderly enrollment in September.

Your CMU Student I.D. number will be the same as your Social Security Number (SSN). Your Social Security Number is listed as 164-50-5409. If this number is incorrect, please notify the Admissions Office immediately, giving the correct number.

We look forward to having you on campus next September. If you have questions or if I can be of any further assistance, do not hesitate to contact me.

PERMANENT ADDRESS:
1810 Rittenhouse Square
Philadelphia, PA 19103

Sincerely,

William F. Elliott

William F. Elliott
Vice President

wfe:bh

GOLDEN, RICHARD TODD P.
164-50-5409 Transfer
College of Fine Arts, Design

NOT VALID
UNLESS
STAMPED HERE
BY CASHIER

Example: Xerox 9700 Form with Variable Data

Mailnet: A Strategy for Inter-Campus Exchange of Electronic Mail

Paul S. Heller
EDUNET/EDUCOM
Princeton, NJ

The purpose of this paper is to describe the setting, concept, operation, and cost of Mailnet, a computer-based system for automatic exchange of messages and files between widely dispersed computers. These computers may each have different and essentially incompatible software (e.g., electronic mail) for message and file creation under user control. Mailnet is not an ultimate solution for the interconnection of computer systems. However, Mailnet has the characteristics of low entry and fixed costs and sufficient functionality to serve the inter-organizational message exchange needs of most universities and colleges for at least several years.

The essential characteristic of Mailnet is that a user can create, send, and receive messages and documents on his/her own system even if the sender or recipient is a user of a totally different system. As far as the user can tell, interaction with foreign users is the same as interaction with local users.

Groups whose members span several organizations could, by agreement, use a single, common mail facility. Use of a system foreign to the user, however, requires that an account be established, that logon and editor commands be learned, that significant communications costs be incurred, that text may need to be rekeyed, and that the foreign system be checked for new mail. In the Mailnet environment many if not all of these impediments are eliminated.

Note: Questions and comments regarding this document are welcome. They should be directed to Paul Heller at one of the following addresses:

1) On GTE-Telenet Telemail: PHELLER/EDUNET
2) On NJIT/EIES: PAUL
3) On Stanford/CONTACT/EMS: HE.EDC
4) On EDUMAIL/MACC-Mail: EDUNET=Central
5) On ARPAmail: PHeller.Educom@MIT-Multics
6) Via U.S. Mail: Paul Heller, EDUNET,
   P.O. Box 364,
   Princeton, NJ 08540
7) Via telephone: 609-734-1874

Mailnet: A Strategy for Inter-Campus Exchange of Electronic Mail

Note: The name "Mailnet" replaces the name "Phonenet" that was used in previous descriptions of this activity.

Introduction

The purpose of this paper is to describe the setting, concept, operation, and cost of Mailnet, a computer-based system for automatic exchange of messages and short files between widely dispersed computers. These computers may each have different and essentially incompatible software (e.g., electronic mail) for message and file creation under user control. Mailnet is not an ultimate solution to interconnection of computer systems. However, Mailnet has the characteristics of low entry and fixed costs and sufficient functionality to serve the inter-organization message exchange needs of most universities and colleges for at least several years.

Background on EDUNET

EDUNET is an international computer service network with a mission of providing its members with cost-effective access to computer and communications services. EDUNET membership includes more than 160 colleges, universities, and related nonprofit educational and research organizations. Sixteen of the EDUNET member schools act as EDUNET Suppliers. Instructional, research, and some administrative computing services at these Suppliers are used remotely by faculty, staff, and students through EDUNET. Through publications, online databases, workshops, and telephone and electronic contact, EDUNET provides information about services available and assistance in use of those services. A complete EDUNET central billing and accounting service makes it easy for members to establish accounts and monitor usage. Other EDUNET services include acquisition of microcomputer and other products and data communications services at discounted prices.

EDUNET has been active in the area of electronic mail and teleconferencing for a number of years. EDUNET provides access to numerous mail systems that are used by members for correspondence, committee discussions, meeting organization, sharing of research results and reports, and many other applications.

The extensive experience with current mail applications and the widespread demand for even more convenient access to electronic mail and to the many currently disconnected communities of users has led to the development of this project that will establish Mailnet as an operating service available to colleges, universities, and other nonprofit organizations.

The Demand for Electronic Mail

The term "electronic mail" has been applied to many different types of message service. In this proposal the term is used to describe systems where humans use an interactive terminal with keyboard and printer or visual display to enter, edit, manipulate, file, or display textual messages. Telex and TWX service are examples of widely used but primitive electronic mail services. Electronic mail is usually considered as a component of the "paperless office." While electronic mail may be printed as a convenience to the user, no paper is required. File copies of messages are stored on the system and no traditional paper filing cabinets are needed.

Almost all computer systems have some primitive form of electronic mail capability. At the simplest level, a computer user may create a file on his account and give another person instructions on how to access his account and print the file. Such primitive systems are generally used only by "computer types" because they lack most of the important convenience features necessary for use by persons without substantial computer experience.

In recent years many organizations have developed mail systems which are very easy to use and have far more functionality than the early, primitive systems. There are many examples of well developed university-based electronic mail systems. At the University of Wisconsin - Madison, a system called EDUMAIL/MACC-Mail is used locally by several hundred faculty and staff and nationally through EDUNET by more than 100 users. Cornell University has developed a mail facility based on CMS that is used extensively by computer center staff with more extensive local use anticipated when user documentation is completed. A reduced form of the Cornell mail system is used nationally by senior business and planning officers at more than 100 colleges,universities and seminaries that access EFPM, EDUCOM's interactive modeling system, through EDUNET. A system called EIES (Electronic Information Exchange System) at the New Jersey Institute of Technology has several hundred users throughout the U.S. and in other parts of the world. A system called CONFER at the University of Michigan and Wayne State University has several thousand local and remote users with a total usage of several thousand hours per month. Both EIES and CONFER are conferencing systems which have features for organized group discussions in addition to electronic mail functions. Stanford (described elsewhere in this paper), MIT, Dartmouth, University of Virginia, University of Southern California, and many other universities have well developed mail systems.

Inter-organizational Mail

Most of the mail systems described above are in fact used by persons from a variety of organizations. These arrangements are largely ad hoc. There are, however, several organized research groups that have or will establish well-structured inter-organizational electronic mail systems.

The ARPANet was the pioneer in establishing interconnections between widely dispersed and different computer systems. The ARPANet is operated by the Department of Defense (DOD) for use by DOD contractors performing research in computer science and related disciplines. More than 100 computers including approximately 20 in university computer science departments are interconnected. Though the ARPANet provides very sophisticated communications services, the most prominent and widely used is electronic mail. Several thousand researchers are active users of the ARPANet mail facilities. Each user interacts with his local system with inter-system messages automatically handled by the network. Unfortunately, the ARPANet is quite expensive (annual cost of $60,000 per site), requires substantial technical talent, and is restricted by DOD policy to be used only by those with DOD or related federal research contracts. Many with access to the ARPANet conduct most of their correspondence using electronic mail.

Another group of computer science researchers has recently received funds from NSF to set up a network called CSNet. CSNet will have much of the functionality of ARPANet but at a lower cost and without the restriction of requiring DOD contractor status. CSNet usage will, however, be restricted to those active in computer science research. When CSNet was being planned, surveys of computer scientists regularly indicated that the highest priority service to be developed was inter-system electronic mail. Two Phonenet systems (similar to Mailnet) will be operated as part of CSNet. The first system began pilot operation in the summer of 1981.

Though CSNet will serve only computer science researchers, all of the software and protocols developed as part of CSNet will be available to other organizations. The Mailnet system described here will draw heavily on the software and experiences in CSNet.

In the cognitive science disciplines, a group of researchers and educators has proposed the establishment of COGNET, a network similiar to CSNet but to serve cognitive scientists rather than computer scientists. The COGNET proposal calls for the early establishment of a Mailnet-type system based on the technology developed in CSNet.

It is not surprising that computer and cognitive scientists are leading the way for inter-system electronic mail service. Many of these scientists have ARPANet experience which demonstrated the value of convenient electronic mail and led each group to consider this service as a most desired tool to be made more generally available within their respective communities of colleagues. Another characteristic of these two groups is that they have very extensive computing experience which permits them to design and implement message transport systems and more sophisticated services using their own expertise. Few if any other disciplines have the necessary expertise though they would derive similar benefits if services such as Mailnet were available.

The Setting

Faculty in many disciplines and staff at colleges and universities are increasingly using terminal-based mail and document systems for communicating messages and authoring and sharing of documents. For example, at Stanford University several hundred persons including senior administrators are using CONTACT/EMS (formerly called TFM -- Terminals for Managers), a system based on Wylbur (a powerful text editor) and SPIRES (a search and retrieval system) for creating and sharing textual information varying in length from one line to 100 or more pages. For persons at Stanford, this is a very effective and convenient means of communicating. Persons outside of Stanford may of course have an account on the Stanford system and thereby become a part of the Stanford electronic mail community. EDUNET, in fact, facilitates this use and numerous individuals and a few organized groups external to Stanford use CONTACT/EMS in this way. However, for the outside user there are a number of impediments even though the Stanford system is well documented and easy to use. The impediments include:

1) the need to establish an account at Stanford

2) the need to learn the logon commands, and the commands for text creating and editing

3) due to the bandwidth limitations of the communications networks, the terminal will be limited to speeds of 30 or 120 characters per second which nearly precludes the use of screen oriented editors

4) the communications costs of being connected during the slow process of text entry and editing

5) the need to re-key information already entered on the user's own system

6) the need to check (sign-on) the Stanford system regularly to see if there are new messages.

Each of these impediments can be overcome by outside users if they are sufficiently motivated. To be widely used, a large group would have to decide to use a given mail system exclusively for this purpose. Experience in EDUNET with EDUMAIL indicates this is not a generally applicable solution for the reasons cited above. The barriers are even more severe when one considers a user who uses (or wishes to use) half a dozen different mail systems in order to interact with different communities of users.

Mailnet Concept

The essential characteristic of Mailnet is that a user can create, send, and receive messages and documents on his own system even if the sender or recipient is a user of a totally different system. As far as the user can tell, interaction with foreign users is the same as interaction with local users. In this Mailnet environment many if not all of the impediments are eliminated.

A simple example can be used to illustrate the Mailnet concept. Foggy Bottom University has many faculty and staff who are users of the FOGMAIL electronic mail system which was developed at FBU and runs on the FBU computer center system. Brian Bottom, a faculty member at FBU uses FOGMAIL and is known as BBottom to his campus colleagues. The situation at Dry Gulch College is similar except that the mail system in use there is called DRYMAIL. Linda Gulch, known in DRYMAIL as LGulch, is a routine user of DRYMAIL. Both Brian and Linda have mastered the text editor available to them, and use their local mail systems daily for both short messages and longer memos and papers.

If both Foggy Bottom and Dry Gulch are participants in Mailnet, then Brian and Linda can exchange messages with each other in the same way they each exchange messages with their local colleagues. Brian would use FOGMAIL to prepare the text of a message to Linda. Brian might address the message as follows:

```
To: (External) LGulch@DGC1
```

The DRYMAIL processor would recognize the keyword "External" and would place the message (with Linda's address) in a file labeled "Outbound Foreign Mail" where it would wait for pickup by Mailnet.

Within a few hours, the Mailnet relay machine will place a direct-dial telephone call to the FBU computer, log on, and pull out and store the contents of the outbound foreign mail file which contains the message for Linda. Within another few hours the Mailnet relay machine will dial-up the Dry Gulch computer, log on, and deliver to DRYMAIL Brian's message to Linda. The next time Linda checks DRYMAIL she will find the message from Brian.

The power of the Mailnet concept is that it is easily expanded to similarly serve many users at each campus and to provide each campus with a message path through Mailnet to many different foreign campuses.

Mailnet Operation

The two primary components of Mailnet are 1) a single Mailnet relay machine, and 2) a potentially large and diverse collection of subscriber systems, each of which operates as a local mail system.

The relay machine could be a small minicomputer dedicated to the message relay function. For less than $100,000 in purchase price, all necessary hardware could be acquired to support the relaying of 300 million characters per month -- equivalent to about 100,000 densely typed pages of text. This traffic level could be supported using four dial-up telephone lines at 1200 bps. each. A smaller volume relay machine could even be implemented on a personal computer. A more attractive alternative, however, is to implement Mailnet on a full-service production system that already has routine procedures for fault diagnosis, prompt restoration of service, file backup, etc. A good environment in which to implement the relay function would be one like the Multics system at MIT. An added benefit of this particular system is that it already has good connections to Telenet, TYMNET, and ARPANet which allows for substantially reduced operating costs for certain subscribers.

The Mailnet relay would be programmed to dial-up each Mailnet subscriber system, automatically logon, retrieve messages destined for other subscriber systems, insert messages from other subscriber systems destined for local users, and then hang-up. The relay would pick the least cost communications channel to connect to each subscriber. The relay would place a local call to (or establish a virtual circuit on) Telenet or TYMNET for those subscriber systems connected to one of those networks. Other subscriber systems would be dialed directly. Fixed costs to the subscriber are minimized because no leased line or other dedicated connection is needed.

Each subscriber would decide how often his system would be contacted by Mailnet. The frequency of contact might typically be every 3, 6, 12, or

24 hours. The more frequent the contact, the less the delay in getting a message to the recipient system. The cost to direct dial subscribers would be minimal if all transfers of messages were handled at night when direct dial rates are lowest.

Mailnet Costs

There are three basic cost components in establishing and using Mailnet: 1) Development of Mailnet relay software and protocol selection/definition, 2) work with and by subscriber staff in implementing subscriber interfaces, and 3) Mailnet traffic charges. The development costs including full-scale testing and pilot operation with several sites will cost $100,000-$200,000. Proposals have been prepared seeking outside funding to support this effort. Subscriber connection to Mailnet will involve a few days of central staff time and a few weeks of subscriber staff time. The specific steps required for connection are defined in the next section. It is expected that the central staff effort will be funded through an annual subscription fee of $1,000-$3,000.

Mailnet traffic charges are almost totally variable (as opposed to fixed) and depend on the type of communication channel used and time of day in the case of a dial-up circuit.

The highest charge would be the case in which both sender and recipient sites are 2000+ miles from the relay site and daytime direct dial is used in both cases. Based on a relay machine charge of $5/hour, a direct dial charge of $27/hour, and a channel efficiency of 75%, the total cost for moving a message from sender site to recipient site would be approximately 20¢ per 1000 characters or about 50¢ for a typical single spaced typed page (2500 characters).

If the message above were transmitted at night, the direct dial charge would be reduced to $11/hour resulting in a total cost of 10¢ per 1000 characters or 25¢ per page. If the sender, the recipient, or both are substantially closer to the relay site, both day and night cost would be reduced further.

If both sender and recipient sites happen to have Telenet or TYMNET connections, the cost per 1000 characters would be 1-5¢ or 2-12¢ per page, regardless of time of day. The wide range here results from the expected wide variation in subscriber policies for recovery of fixed Telenet or TYMNET costs.

Connecting to Mailnet

Each site (host) wishing to subscribe to Mailnet would be responsible for implementing and maintaining software and procedures on its host to support functions required for use of Mailnet. These functions would include:

1) Sign-on procedures. The subscriber would specify the exact set of commands and parameters ("run" statement, account number and password, telephone number, etc.) to be embedded in the Mailnet software so that it could automatically establish the connection to the host.

2) Error control protocol. In order to eliminate virtually all line errors, the host would need to implement a simple Mailnet standard asychronous error control protocol. This link level protocol would provide for the robust transport of 7 bit ASCII data over ordinary telephone connections. Error detection is by means of a character oriented block checksum. Error correction is accomplished by block retransmission. The communications channel is used in half-duplex mode to allow for simple implementation on virtually any subscriber system.

The protocol may be implemented as an ordinary user program on the subscriber system. An escape sequence is used to encode characters (e.g., form feed, carriage return, etc.) that would otherwise be intercepted by some element (e.g., subscriber front-end computer) in the communications path. All protocol parameters including block (packet) length and escape character may be negotiated at the start of each connection. EDUNET will work with Mailnet subscribers to share code implementing this protocol.

3) Message queues and envelopes. Outbound messages (subscriber to distant addressee) would each be enclosed in a standard message envelope and placed together in a standard location (i.e., a named file). The Mailnet relay would transfer all outbound messages from this location. A separate file space would be designated for inbound messages in standard envelopes. The host would be responsible for distributing messages to individual users (i.e., putting the messages in the user's private file space). To the extent possible the message envelope standard would be consistent with the ARPANet standard (RFC#733) or the recently developed NBS standard which provide a common format for message elements including sender, recipient, and host identifiers.

Billing

Bills would be rendered once a month to each subscriber site. Bills would be available in hard copy form or in a machine readable form as a message. Billing of individual users would be the responsibility of the subscriber site.

All variable charges associated with relayed messages would be billed to the host site from which the message originated (i.e., the "sender"). The variable charges would have three components: 1) origin to relay, 2) relay processing, and 3) relay to destination. Each of these components would be in terms of a rate "per 1000 characters" that would depend on method of connection (Telenet, TYMNET, or DDD) and time of day. By using simple rate tables, a sender could accurately predict the cost of sending a message. For user convenience and simplicity it would be desirable to have a single rate regardless of the origin and destination. However, a single rate would mask significant differences in cost due to time-of-day and the presence or absence of Telenet/TYMNET service.

Addressing

The Mailnet relay would verify the destination site ID of each message before accepting it. Verification of individual user addresses would not be a responsibility of the relay. In general, the sender would need to know the correct site ID and user address of the recipient of the message. EDUNET will publish an up-to-date list of Mailnet site ID's. At a later date EDUNET may publish (in hard copy and/or online) a directory of addresses of individuals who are reachable via Mailnet.

Many persons have commented on the very high desirability of a common directory facility that would give senders convenient and prompt access to the Mailnet address of intended recipients. A good analogy to this problem is that of trying to find the work telephone number of a person at a distant college. In the case of a telephone number, one may call the college switchboard or the appropriate departmental office and usually obtain the correct number. The same technique could be used to obtain Mailnet addresses if the telephone switchboard or departmental office staffs maintain such information.

Other techniques for directory assistance are being considered including centralized and distributed online databases. However, maintaining currency of such databases is extremely difficult and interactive access by end users may be inconvenient.

Multiple Systems on a Single Campus

On many campuses, especially larger campuses, there is typically a campus computing center which operates one or a few large mainframes, and several small to medium size systems operated by departments. Electronic mail systems may be available on several of these computers. In terms of Mailnet, more than one of these systems may independently subscribe to Mailnet service. Conversely, if one of the campus systems (e.g., the computing center) acts as a local message collection and distribution point, then a single Mailnet interface can serve users on all campus systems. .

Relationship to Microcomputers and Word Processors

Microcomputers such as the Apple II are now in widespread use in colleges and universities. Microcomputers are attractive for certain text handling applications because of their low operating cost and the availability of full screen text editors. In fact the Apple II with the UCSD Pascal editor and the EASy software package distributed by EDUNET is designed to support electronic mail message creation and automatic transfer to EDUMAIL at the University of Wisconsin.

During the first year of operation, Mailnet would not interact directly with microcomputers. Microcomputers tend to be moved from place to place, their hardware and software may be reconfigured frequently, and they tend not to be regularly available to receive dial-up calls as would be required in Mailnet. At a later date Mailnet may be extended to support dial-in service from microcomputers. Such an extension would not be technically difficult but it would require additional measures to protect Mailnet from "tampering" and also would require billing and administrative arrangements with a potentially large number of microcomputer owners.

Small stand-alone word processors (e.g., Lanier, Vyadec) would also not interact directly with Mailnet. Small word processors tend not to have communications capability and are not user programmable. Consequently, even the simple Mailnet protocols may not be implementable on many of these systems.

Even though they would not interact directly with Mailnet, both word processors and microcomputers could have indirect access to the full set of Mailnet services by making suitable arrangements with one of the regular Mailnet subscriber systems.

PRIORITIES AND CONFRONTATION

ALEX VARSEGI

BOARD OF GOVERNORS
OF
STATE COLLEGES AND UNIVERSITIES
COOPERATIVE COMPUTER CENTER

ELMHURST, ILLINOIS

The Board of Governors Cooperative Computer Center, located near Chicago, provides systems and hardware support for three state universities in the area. The Computer Center functions to achieve economy through design emphasizing generic values with minimal customizing. The Center desires that each school be treated democratically, but project implementation decisions are made by people representing conflicting interests. Personnel at the Computer Center frequently experience a volatile environment, drawn into the center of confrontation. When priorities of one university are matched against those of another, there may be an alarming number of discrepancies to be resolved. Lobbying for acceptance of a project involves political turmoil and difficult decision-making demanding a great many compromises.

- BACKGROUND

The Board of Governors Cooperative Computer Center, located in Elmhurst, one of the western suburbs of Chicago, currently provides full-blown systems and hardware support for three major state universities in the Chicago area. These are Chicago State, Northeastern Illinois and Governors State Universities.

One of the main functions of the Computer Center is to achieve large-scale economy. This is accomplished for the three schools through the continuous development of systems design emphasizing generic values during developmental phases, at the same time minimally customizing the systems.

The Board of Governors Cooperative Computer Center is essentially a consulting firm satisfying the computing needs of a number of academic and administrative users. The Center was initially created by the Board of Governors of State Colleges and Universities in July, 1971. July 8, 1974, three Board of Governors Universities in the Chicago metropolitan area completed the consolidation of data processing activities into the new Cooperative Computer Center. The organization is accountable to a Policy Advisory Board made up of the Presidents of Chicago State University, Northeastern Illinois University and Governors State University and the Executive Director of the Board of Governors. The Policy Advisory Board has delegated authority from the Board of Governors for management of the Center. The Center is managed by an Executive Director and is organized in a relatively traditional fashion, containing computer operations/service delivery, systems design and programming. The Cooperative Computer Center employs about 75 people as programmers, systems analysts, computer operators, data control specialists, data entry operators and administrative support staff.

- NEW SYSTEMS CONFIGURATION EFFECTIVE JANUARY, 1982

The central computer facility will be centered on an IBM 4341 processor. Each one of the campus facilities will utilize an IBM 4331 processor in local telecommunications mode with a number of 3279 CRT type terminals attached to it through CICS. There are, in addition, CRT terminals for central site programming, text editing and job submission. The facility utilizes COBOL as the primary programming language and supports a wide range of other languages and packages.

- HISTORY

Prior to the establishment of the Cooperative Computer Center, the three universities relied essentially on the services of a facilities management firm for approximately five to six years. During this period, the entire shop operated purely in maintenance mode. Few systems were designed; even less became operational. Those systems eventually implemented were placed into production virtually without any user input. A typical example of this is the payroll system that was designed and implemented in approximately eight months or less. This system is so inflexible that even the slightest modification of it (i.e., adding a new insurance vendor to the procedure which is normally a table-driven operation) at times becomes a major, time-consuming task. Since both the State and Federal Government operate in a rather dynamic environment, there are times quite frequently when very little time is allowed for implementing new sets of computer procedures. Often, under those circumstances the system seems much too cumbersome and inflexible to handle high priority requirements, especially to handle them within a given time frame. This situation normally leaves the user feeling helpless, angry and dissatisfied with the existing system. He is resentful that he had no initial input to the original design. It seems obvious that the facilities management firm provided little or possibly no leadership in the required areas, nor did it have common sense in its dealings with the user. A programmer who was requested to implement an important change affecting the current payroll system, for example, would do so on a Friday afternoon, virtually without any testing to verify the anticipated result. Afterwards he would proceed with his previously planned vacation, leaving the system quite vulnerable in terms of normal performance. Incidents like this would leave the user community not only furious but convinced that the regime could not handle what was expected of it and did not realy care.

- NEW AGENCY MAKEUP

After terminating the services of the facilities management firm, the Cooperative Computer Center was thoroughly reorganized. People were brought in with a great deal of experience who were then part of the system, a move designed not only to upgrade the overall level of competence but to be quite prudent politically, as well. Restoration of user confidence in this data center was sought by having users dealing with their own kind, theoretically.

When the author of this paper commenced working for the recently reorganized Cooperative Computer Center during the first part of 1980, he was brought on board with the specific task of implementing a new Payroll/Personnel System. Being somewhat naive, he assumed erroneously that the user community had agreed previously on the above priority. It was his understanding that priorities were essentially set by the top echelon at the respective universities, routinely involving the Board of Governors.

• THE HUMAN RESOURCE SYSTEMS COMMITTEE

In order to provide proper representation for the user community and extensive involvement on their part, a Human Resource System Committee was organized to oversee and monitor the activities of the new University Support Systems team. In an overanxious move aimed at minimizing the past paranoia resulting from little or no user participation, the author of this paper, with his staff, decided to emphasize user involvement to a much greater degree than would normally be justifiable. Users were now included in several processes, ranging from the needs analysis to the phases of the actual design . . . users whose particular interest seemed more pressing than the immediate priority allocated to the new Payroll/Personnel System.

Since the title "Human Resource System Committee" was used relative to the task force, it soon became a misnomer. Somehow, it seemed to denote a relatively broader area than originally planned. Thus, instead of dealing strictly with Payroll and Personnel users, other units such as Institutional Research, Academic Affairs, etc., increasingly began to overshadow the activities of the Committee. Institutional Research lobbying would become intense. The validity of the priorities scheme, manner of setting priorities, and how the decision relative to developing a new Payroll/Personnel System was made (when other requirements seemed to be a great deal more acute) were all questioned. The argument was simple and logical: the current payroll system is at least automated and keeps audit trails of checks generated. Other vital areas, however, have not been in the least automated or explored. The author of this paper has been accused a number of times of making capricious, arbitrary decisions, playing favorites to the detriment of an entire university, and so forth. Needless to say, the author was more than surprised at the tone of the accusations, since he was originally brought in to implement a specific set of tasks, among which a new Payroll/Personnel System was clearly of top priority. Even when initially organizing his team, he placed special emphasis upon hiring people with substantial Payroll and Personnel experience.

- PROBLEMS INVOLVING PRIORITY DEFINITIONS

From the wide range of arguments presented at the various meetings, it became apparent that there was disagreement among the users, not only about the setting of priorities but also as the result of general disagreement among the three universities and within each university. For example, representatives of one university felt that a new Cost Study system would be a great deal more beneficial for them. Representatives of another university felt, however, that certain business functions were a great deal more viable and realistic in terms of top priority and possible implementation.

Apparently, the decision to develop a new Payroll/Personnel System was made in the higher echelons involving the Board of Governors and the respective presidents of each university, and somehow it never permeated through the organization as expected. Possibly the middle management and the lobbying interest groups found it convenient to be ignorant of such prior decisions. Thus, the Human Resource System Committe, like the League of Nations brought into existence for accomplishing a set of goals, now became a forum for voicing opposition and general discontent by those seeking political and personal advantage.

- PRIORITIES IN TERMS OF PHASES

A new approach, Phase 2, based upon a variety of direct user requirements, was developed to reassure some of the user community that their special needs would soon be handled. The original project, Phase 1, would still remain the implementation of a new Payroll/Personnel System. However, Phase 2 would officially acknowledge the pre-eminence of a new set of priorities having to do with Institutional Research, Cost Study and Academic Affairs, to mention a few.

- PRIORITIES IN GENERAL

Generally speaking, the setting of any priorities may be a volatile, sensitive issue and should be removed as much as possible from the responsibilities of the data processing professional. Undoubtedly, one of the resources and effort-saving functions of the Cooperative Computer Center is to emphasize and encourage the use of common, generic software among the user community. However, conflicting priorities must be dealt with, simply because any given data processing entity should remain responsive at all times to a reasonable array of individually customized priorities. When the author of this paper was employed by the University of Illinois at the Medical Center, for example, and subsequently by Loyola University of Chicago in Maywood, Illinois, priorities were eventually settled within the organization, data processing being always removed from the final decision-making process. However, the Cooperative Computer Center cannot operate in conventional fashion because a high priority topic with the President of Chicago State may be a relatively unimportant requirement with his counterparts at Northeastern Illinois and Governors State Universities.

A new, previously taboo word now enters the picture: COMPROMISE. "Compromise", according to Webster, "is to reach an agreement by mutual concession". It is also "to expose to risk or suspicion". Fixing priorities and accepting them can be a purely political issue; it may be neither efficient nor a sensible way of selecting. It does, however, remove a great deal of blame and responsibility from the data processing community, which it, in all probability, does not wish to assume.

The inequality that emerges out of the internal compromise process is such that users of lesser importance on the political scale experience a great deal of insensitivity - but insensitivity on the part of the entire organization rather than of the data processing professionals alone.

Also, deciding upon priorities, selecting among a number of available courses of action, is essentially an economic decision that, like capital investment, must be carefully analyzed by those outside of data processing. Human resources are more expensive than hardware. They are not only costly but limited in scope by the availability of specialized experience, by an unpredictable learning curve and by the ever-present conflict of interest. The author of this paper suggests that in deciding upon a particular application a happy balance must exist between the extent of saving to be achieved by automation and the length of time within which a given project must be implemented. As previously stated, the author of this paper suggests that any decision relative to a major project must be external to the environment of any successful data processing entity.

- USER SELF-RELIANCE ON SMALLER TASKS

Since portions of a number of new systems are now being developed by use of interactive technology, a great deal more responsiveness can and will be expected of the Cooperative Computer Center. Beginning with Fiscal 1982-83, the Center will be utilizing a comprehensive yet powerful on-line query language thoroughly user-oriented. This language will allow the user to access a number of different databases (within proper security arrangements) and retrieve the information in the required format and sequence. An on-line printer attached to the CRT-type terminal will generate hard copies of the image displayed, if required. This will give the user a great deal of the autonomy to which he is accustomed.

Another area yet to be extensively explored is the use of a complementary word processing environment. Since at some future point word processing will have to be integrated with other data processing functions, standards and procedural documentation are now being generated by the Cooperative Computer Center.

IMPROVING FINANCIAL AID DELIVERY THROUGH AN ELECTRONIC DELIVERY SYSTEM

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ST. LOUIS, MISSOURI

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I. INTRODUCTION

This paper reviews activities to date of Project TRANSACTION -- a major research and development project of the College Scholarship Service division of the College Board -- intended to unify the student financial aid delivery system through application of electronic information technologies. With the assistance of Arthur D. Little, Inc., the CSS has recently completed a strategic planning process to investigate ways that currently available and emerging information technologies could be applied to improve the delivery system for financial aid. This paper reviews the project's history and background, current activities and plans, and its implications for university data processing officers.

II. THE BACKGROUND OF PROJECT TRANSACTION

Since its founding in 1900, the College Board has had a commitment to support both access to postsecondary education and choice among such opportunities. Working within that mission of the College Board, the College Scholarship Service (CSS) is responsible for providing financial aid services that support equitable distribution and delivery of financial aid to needy students. A specific goal of the CSS is to eliminate financial barriers that limit student access and choice.

Through the CSS, the College Board has contributed significantly to the current financial aid delivery system through several important concepts and services, including:

- awarding financial aid based upon need, and not just academic merit;
- central processing of family financial information;
- a common form for collection of data in the financial aid application process;
- the Uniform Methodology used to calculate financial need and parental contribution; and

- Multiple Data Entry (MDE) for the collection of data through one instrument, to serve as the basis for awarding institutional, state and federal funds, including the Pell Grant Program.

The environment of financial aid delivery is constantly changing. The current delivery system for student financial aid is dependent upon paper-based processes. The delivery system has been stretched -- perhaps to its limit -- in the past two decades by the large increases in both dollars awarded and numbers of students served. Further, the current system has limited capacity to support new patterns of financing postsecondary education which are expected to emerge in the next decade.

It is expected that the paper based-system will soon be replaced by a system using more current and efficient information technologies. Realization of this expectation is dependent upon establishing the necessary agreements, standards, and principles to permit application of available information technologies in a cost effective and efficent manner, while embodying the values of the financial aid community.

Recognizing this need, the CSS commissioned Arthur D. Little, Inc., to assist in a study which lead to the preparation of a strategic plan for development of a unified financial aid delivery system, more effective and efficient than the current system and yet based upon the established principles of student aid administration. As the basis for the resultant Five Year Strategic Plan -- in which the CSS mission is reflected first in strategic goals, next in specific strategies, and then in actions to realize those goals -- the study identified:

- an overall analysis of student aid delivery, as experienced by students and their parents;

- the external driving forces affecting the delivery of student aid;

- the resources and constraints which would affect a solution to the problems of student aid delivery;

- the need for all participants in the process to participate in and to benefit from an improved student aid delivery system;

- new CSS products and services that both relate to the strategic goals cited in the Plan and contribute to the creation of the unified delivery system, and

- potential partner organizations which might be commissioned by or join the CSS in order to achieve the established goals. (Specific emphasis was placed upon potential partners with established information technology resources and capabilities.)

The activities associated with the study included:

- appointment of a project team to be responsible -- following the recognized priorities -- for creation of the project objectives and functional specifications for the proposed system and for the pilot phase of the system;
- appointment of a project steering committee from within the CSS membership to assist the project team in review and modification of the plan and in identification of areas of greatest need which are to be implemented first;
- review and endorsement of the Plan by the established governance committees of the CSS;
- approval by College Board management for research and development funds for the purposes of establishing initial agreements among the potential project partners, developing the concept further, and seeking additional funding for the project; and
- introduction of the overall concepts of the project to the CSS membership at the October 1981 Annual Meeting of the College Board.

III. SCOPE AND APPROACH OF PROJECT TRANSACTION

The scope of the system has been significantly refined from the initial suggestions developed by Arthur D. Little, Inc., through frequent review and modification by the CSS Steering Committee and the CSS Project TRANSACTION Team. This interaction has also ensured that TRANSACTION is under the leadership and direction of the CSS on behalf of its membership.

The TRANSACTION system is intended to assist all participants in student financial aid delivery system in making a transition from the current paper-based, batch-oriented system. TRANSACTION is based upon an electronic network that links students and their families with postsecondary institutions, state and federal agencies, commercial lenders, and private processors. These participants interact in the current process, but primarily use paper as the mode of communication and, frequently, the interaction requires movement of the paperwork from one agency through the family to another agency, rather than data flowing directly from agency to agency.

The technologies that support the TRANSACTION concept all exist today, are commercially available, and have been applied to service delivery functions in other industries. These technologies include:

- data base management systems, with a central data base containing profile and summary data held in other data bases, information used to identify and then facilitate sharing selected information among all the participants involved in the delivery of financial aid;

- electronic communications network;
- electronic funds transfer methods;
- office automation and information management approaches;
- distributed processing;
- data base publishing;
- electronic image processing; and
- home information delivery.

The innovation TRANSACTION provides is the manner in which these technologies are being combined and implemented.

Project TRANSACTION has as its goals the creation of a fully unified financial aid delivery system. The system will probably take at least ten years to be fully implemented, but key aspects of the system may be available as early as 1985. A view of the system, as developed through the study is presented as Figure 1. The process would be as follows:

- A student and/or parent would sit down at a terminal in a high school (or other public place) and access the information system. They would enter data to identify the student and the basic family financial data. They would get back on the screen an estimate of their family contribution. The student would indicate those agencies/institutions to which the data was released. By entering codes of prospective institutions, cost and estimated award data would appear. A hard copy of this report would also be available. They could order publications that explain various financial aid programs, and request any additional forms required by the participating agencies/institutions.

- Later in the process, a financial aid officer would use a terminal to access the student's application information which had already been entered into the system. Any necessary changes to the existing data could be entered into the system at that time. A tracking mechanism would be automatically set in place to record activity about the student. Through rules predetermined by the Financial Aid Officer, the aid package would be determined. A student loan could be secured from a participating lending institution. Appropriate paperwork for documenting the student's financial aid package would be printed.

- Upon confirmation of the student's enrollment, funds from federal, private, and institutional sources would then be electronically transferred to the designated educational institution. Management reports and research data would also be available for use on the campus.

The pilot phase of TRANSACTION will link financial aid officers with their counterparts in other aid-granting agencies, lending institutions and other organizations involved in the delivery of financial aid. This linkage will be accomplished through an electronic communications network and central data base containing profile data and indicators for presence of data held in the other data bases linked to the central data base. Original input into the system will be done, in part, through the existing Multiple Data Entry (MDE) system that collects family financial information to determine parental contribution and financial need for federal, state and institutional programs. Students will also enter the system via a modified Guaranteed Student Loan application form.

A summary of the pilot Project TRANSACTION is presented in Figure 2. The pilot system will include electronic communications linkages among:

- MDE need assessment servicers;
- colleges and universities;
- lending institutions;
- cognizant guarantor agencies; and
- secondary market agencies (after the initial year of the pilot).

These electronic linkages will be supported by a central processing organization with experience in providing on-line data processing and communications support.

Defining the scope and concepts to be demonstrated in the pilot phase of TRANSACTION has been a major activity of the TRANSACTION Project Team. Seven major points have been established as priorities for the pilot project:

- establish and share a core student data base with all agencies involved in the delivery of financial aid;
- utilize a communications network to permit access of relevant information by all agencies to which the student has released data and participate in the awarding and delivery of financial aid;
- facilitate loan referral, placement, and guarantee activities through the communications network;

- process state grant eligibility through the network;
- provide educational institutions and lending agencies a financial aid need analysis mechanism through the communications network;
- provide educational institutions with a student aid award record (i.e., processed and reported back) through the communications network; and
- furnish necessary research and reporting capabilities to all pilot participants.

The CSS Project Team is currently reviewing the above minimum activities to refine the scope of the pilot project system. The design will also be reviewed by representatives from the pilot state(s) and CSS Steering Committee before it is finalized.

The approach being used to design and implement TRANSACTION is a cautious one. A limited pilot project will be implemented first, in preparation for a national system to be available in 1985. The CSS is committed to an orderly and disciplined product development methodology based upon the following four major phases:

- Project Objective Definition -- defining the scope and architecture of the pilot system, and development and implementation support necessary to meet the system objectives;
- Functional Specification -- development of the functional specification of the pilot system, further detail of the system architecture, and implementation procedures;
- Product Development and Pilot Testing -- development of the pilot system and implementation in the pilot state(s); and
- National Implementation -- based upon the needs and requirements identified during the pilot phase, implementation of a national system.

Currently, TRANSACTION is a College Board research and development project. There has been strong support articulated from the various agencies needed to make TRANSACTION successful. Before proceeding with the pilot development, agreements with the major agencies must be confirmed and funding from various sources committed. Activities are well underway to complete these essential next steps.

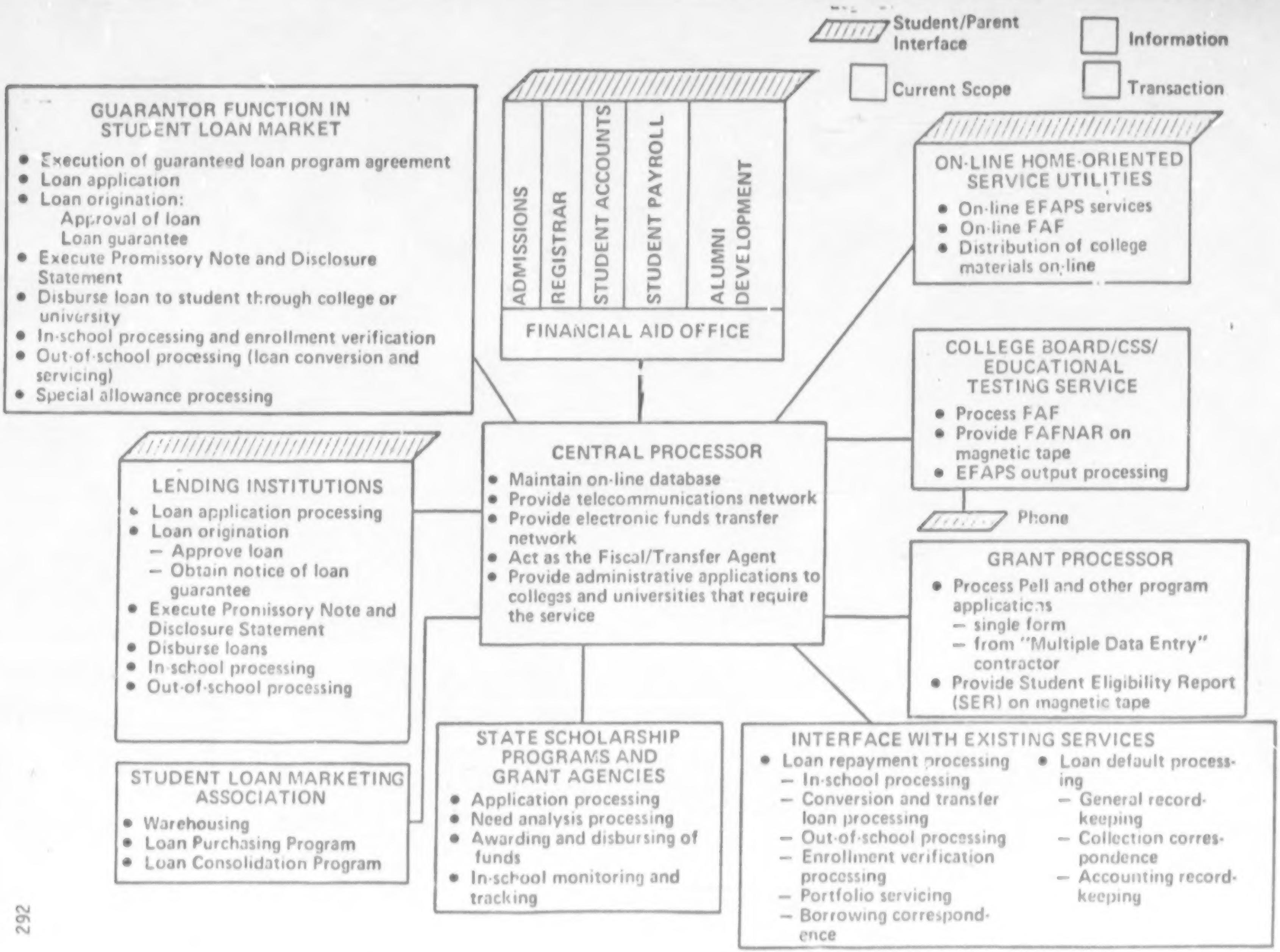
IV. IMPLICATIONS FOR CAUSE MEMBERSHIP

One implication of TRANSACTION to be assessed by educational institutions is that major administrative systems, such as financial aid, are no longer institutionally-bound systems. In fact, one of the greatest difficulties for those who design and implement institutionally-based financial aid systems is coping with the diverse sources from which institutions receive financial aid information and funds. In the 1980's, information technologies will be applied to improve this interface between external information sources and internal data processing/word processing systems. This trend is a shift away from institutionally-bound concept of student records systems designed to collect, store, and report student information from the point of admission through registration and to alunmi functions. A key concept supporting TRANSACTION is that collecting, storing, and reporting student information may be made more efficient and effective through interfacing with these external communications networks.

From a strategic point of view, institutions will need to develop positions with regard to the emerging network for delivering financial aid. External trends and internal capabilities will need to be assessed, constraints identified, and institutional strategies developed and assessed. The potential for this network adds a new option for institutional support to the delivery of financial aid. From an institutional point of view, it is likely that positioning will be determined by the current use of data processing in the institution's financial aid function:

- Established, Existing Systems -- for institutions that have developed or bought financial aid systems, interfacing with the network may be only for those services which cannot currently be performed by the existing institutional system;
- Evaluating Replacing Existing Systems -- in evaluating replacement of existing systems, buying services and/or software modules from the network to meet established institutional requirements may be viable; or
- No Current Data Processing Services -- acquiring services and/or products from the network, or a combination that permits use of on-line systems in a service bureau environment and then brings certain components of the systems in-house, according to institutional requirements may be chosen.

Assessing the implications of this project from each institution's point of view and specific requirements is encouraged. Progress of Project TRANSACTION will be reported through professional association conferences of each of the professional areas encompassed by TRANSACTION -- including CAUSE -- and through regional and national meetings of the College Board.



GUARANTOR FUNCTION IN STUDENT LOAN MARKET

- Execution of guaranteed loan program agreement
- Loan application
- Loan origination:
  - Approval of loan
  - Loan guarantee
- Execute Promissory Note and Disclosure Statement
- Disburse loan to student through college or university
- In-school processing and enrollment verification
- Out-of-school processing (loan conversion and servicing)
- Special allowance processing

ON-LINE HOME-ORIENTED SERVICE UTILITIES

- On-line EFAPS services
- On-line FAF
- Distribution of college materials on-line

COLLEGE BOARD/CSS/ EDUCATIONAL TESTING SERVICE

- Process FAF
- Provide FAFNAR on magnetic tape
- EFAPS output processing

LENDING INSTITUTIONS

- Loan application processing
- Loan origination
  - Approve loan
  - Obtain notice of loan guarantee
- Execute Promissory Note and Disclosure Statement
- Disburse loans
- In-school processing
- Out-of-school processing

CENTRAL PROCESSOR

- Maintain on-line database
- Provide telecommunications network
- Provide electronic funds transfer network
- Act as the Fiscal/Transfer Agent
- Provide administrative applications to colleges and universities that require the service

GRANT PROCESSOR

- Process Pell and other program applications
  - single form
  - from "Multiple Data Entry" contractor
- Provide Student Eligibility Report (SER) on magnetic tape

STUDENT LOAN MARKETING ASSOCIATION

- Warehousing
- Loan Purchasing Program
- Loan Consolidation Program

STATE SCHOLARSHIP PROGRAMS AND GRANT AGENCIES

- Application processing
- Need analysis processing
- Awarding and disbursing of funds
- In-school monitoring and tracking

INTERFACE WITH EXISTING SERVICES

- Loan repayment processing
  - In-school processing
  - Conversion and transfer loan processing
  - Out-of-school processing
  - Enrollment verification processing
  - Portfolio servicing
  - Borrowing correspondence
- Loan default processing
  - General recordkeeping
  - Collection correspondence
  - Accounting recordkeeping

FIGURE 1 FINANCIAL AID DELIVERY SYSTEM
COLLEGE BOARD/COLLEGE SCHOLARSHIP SERVICE

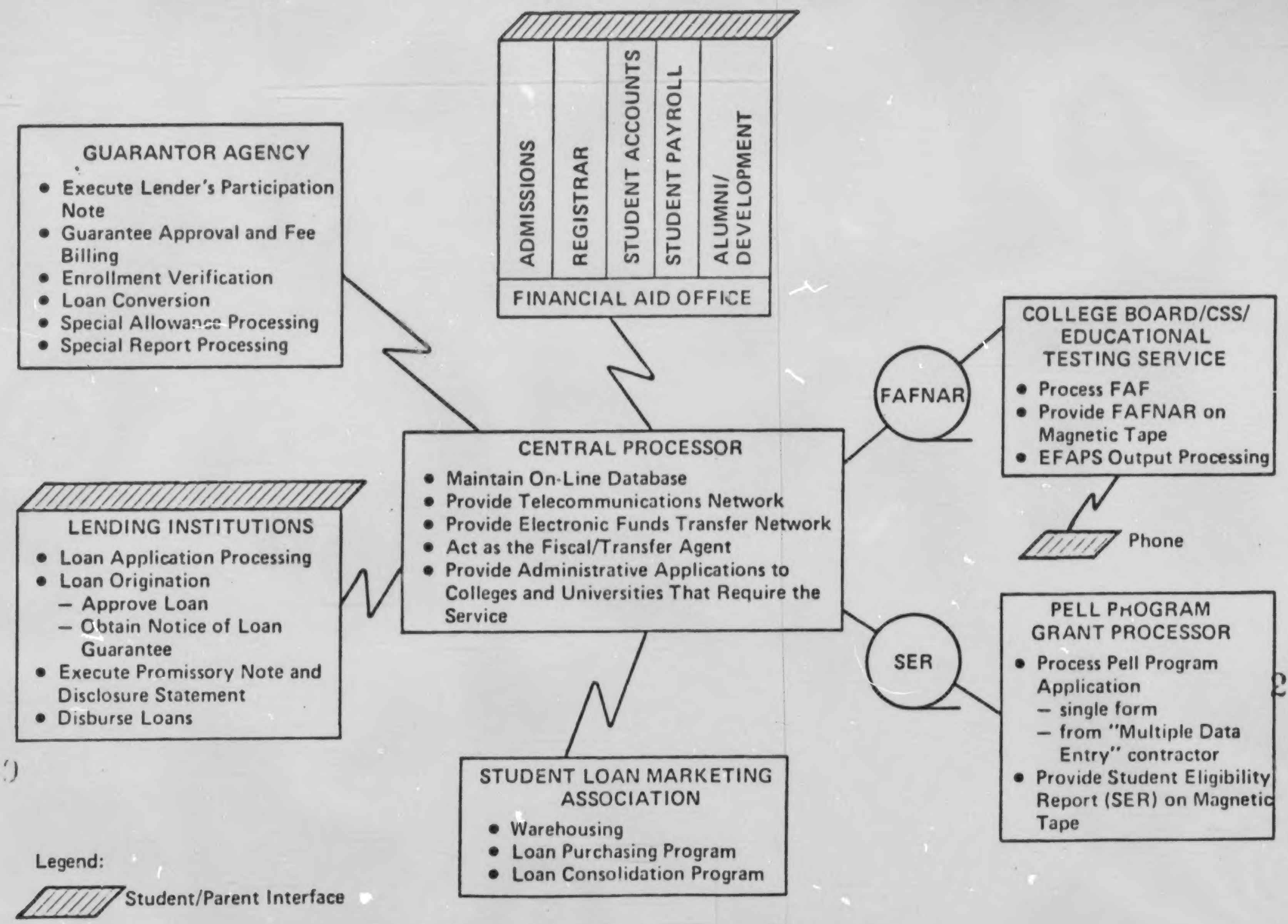

ADMISSIONS
REGISTRAR
STUDENT ACCOUNTS
STUDENT PAYROLL
ALUMNI/ DEVELOPMENT
FINANCIAL AID OFFICE
GUARANTOR AGENCY
• Execute Lender's Participation Note
• Guarantee Approval and Fee Billing
• Enrollment Verification
• Loan Conversion
• Special Allowance Processing
• Special Report Processing
COLLEGE BOARD/CSS/ EDUCATIONAL TESTING SERVICE
• Process FAF
• Provide FAFNAR on Magnetic Tape
• EFAPS Output Processing
FAFNAR
Phone
CENTRAL PROCESSOR
• Maintain On-Line Database
• Provide Telecommunications Network
• Provide Electronic Funds Transfer Network
• Act as the Fiscal/Transfer Agent
• Provide Administrative Applications to Colleges and Universities That Require the Service
LENDING INSTITUTIONS
• Loan Application Processing
• Loan Origination
– Approve Loan
– Obtain Notice of Loan Guarantee
• Execute Promissory Note and Disclosure Statement
• Disburse Loans
SER
PELL PROGRAM GRANT PROCESSOR
• Process Pell Program Application
– single form
– from "Multiple Data Entry" contractor
• Provide Student Eligibility Report (SER) on Magnetic Tape
STUDENT LOAN MARKETING ASSOCIATION
• Warehousing
• Loan Purchasing Program
• Loan Consolidation Program
Legend:
▨ Student/Parent Interface

FIGURE 2 PILOT TRANSACTION SYSTEM

TRACK IV
SMALL COLLEGE INFORMATION SYSTEMS

Coordinator:
William G. Verbrugge
Ball State University

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Old Dominion University

Patricia R. Gustavson
John Brown University

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University of Santa Clara

An On-line Fund Raising System for a Private University

Mikes Sisois and Constantin Delivanis

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Abstract

This paper describes some of the most salient aspects of the Fund Raising system implemented at the University of Santa Clara's Information Processing Center. The system supports all University Relations activities carried out by a number of departments on campus. The paper begins by tracing the evolution of the system over the last five years, then proceeds to describe the structure of its major functional components: the data base, the data base management subsystem, the online inquiry and reporting subsystem, and the batch reporting subsystem. The discussion primarily focuses on the user's view of the system and emphasizes some of its more interesting aspects such as: the integrated data base, the use of the data dictionary to centralize control of the data base, the extensive use of online facilities for transactions and reporting, and the extremely flexible batch reporting facility. The paper concludes with some utilization statistics and a brief summary of user experiences and attitudes toward the system.

Introduction

The University of Santa Clara is the oldest institution of higher education in the western United States, founded in 1851 by two Jesuit fathers on the grounds of the Mission of Santa Clara. It began with a dozen students and a handful of teachers and has grown to a major University in the heart of California's Silicon Valley educating 7400 students in more than 30 undergraduate, graduate and professional programs. The University also maintains close ties with some 25,000 Alumni and its Non-Alumni friends and benefactors. In 1977, under the guidance of the President William Rewak S.J., the University Administration decided to increase significantly its emphasis on development activities. Until that time, these activities were supported by several fragmented and aging systems. It was apparent to everyone involved that a new information system had to be implemented which would integrate support for Fund Raising, Alumni Contact, and University Relations activities, and allow the departments involved in these activities to operate efficiently and effectively. The Information Processing Center was charged with the responsibility of designing and implementing a system that would meet the needs and specifications of the Development, Alumni and Business offices. The initial version was operational in June of 1979. The system was since then revised and expanded several times until it reached its present structure in September 1980. It is now known on the campus as the Gift Information System (GIS), even though its scope is far greater than simply accounting for the gifts received by the University (however, it does that quite well).

System structure

This section will briefly discuss some of the considerations that have heavily influenced the system design and the overall system structure. Almost every one involved in the design process agreed that the system should provide its users with instantaneous access to information. Several important design decisions were influenced by this objective. The system was designed to operate in a DBMS environment and every effort was made to centralize and share the Data in an efficient manner. Since a central data base replaced numerous segregated subsystems, data duplication was all but eliminated. This fact alone provided very significant benefits to all departments involved in terms of saving time and increasing accuracy. All maintenance activities for the data base are performed on-line with immediate update of the permanent record (No transaction files and overnight processing is ever needed). The actual data base maintenance function was distributed to the user departments that generate the data. A sophisticated self contained Data Base Maintenance facility was developed to allow the users to enter and maintain every item of information the data base was capable of storing, on-line in immediate update mode. A complex quality control and monitoring facility based on a data dictionary was added to the Data Base Maintenance package,to insure integrity and to monitor data base usage. The on-line reporting subsystem was designed to allow the users to inquire and retrieve data base records on-line at their terminals. The reports in this subsystem are parameter driven, and selection options can be quite complex especially when combined with the word processing and batch selection modules.

In the interest of better resource utilization, a batch subsystem was provided to generate reports that are too voluminous or time consuming to run on-line. However, this subsystem features a uniquely flexible structure which makes it extremely useful for fund raising work. Each of these subsystems is described in more detail in the following sections.

The Data Base Management subsystem

The Data Base Maintenance subsystem is a collection of cooperating programs and data files which allow the user to enter, modify, and maintain all data items contained in the GIS Data Base. This subsystem provides a unified framework of functions and facilities within which all data base entry and modification can be carried out easily and effectively in an on-line interactive mode. The subsystem interfaces with the Data Dictionary component to provide a comprehensive data editing and control facility. From the system designer's point of view, the Data Base Maintenance subsystem provides significant advantages in terms of minimizing the load placed on the Computer, and in terms of providing a standardized and consistent approach to data maintenance. From the user's point of view, the system provides a friendly and convenient way of performing a large number of tasks related to data base maintenance without having to remember a large number of varying rules. The heart of the Data Base Maintenance subsystem is a package of programs, known to the user as the DATA BASE MANAGER, which provides data entry and maintenance facilities. Following is a brief summary of them.

Activating a Data Base: Before accessing a Data Base, the user must activate it. At that time certain security checks are made available to the DATA BASE MANAGER and any quality checks that are active at that time also become known to the DATA BASE MANAGER.

Adding New Entries: All necessary facilities for adding new entries to the Data Base are available to authorized users in a few concise commands. The user may define partial records for entry, if needed, or may add to a variety of data files within his Data Base. The user may also define the sequence in which the system prompts for each Data item to match the opriate source document. Each field entered undergoes exhaustive checking, as defined by the Data Base Administrator.

Modifying Existing Entries: The DATA BASE MANAGER provides extensive facilities to the authorized user for updating entries in data files. The user has wide flexibility in defining the sequence of operations, that is, which Data items get updated and in what order. He may select any combination of existing Data items or any combination of existing Data Sets. Each Data item's present value is displayed before a change is made. Each change undergoes exhaustive quality control checks, predefined by the Data Base Administrator.

Deleting Existing Entries: The DATA BASE MANAGER allows authorized users to delete existing entries from the Data Base. The user may optionally define any number of fields to be displayed and verification to be obtained from the keyboard before the actual deletion occurs.

Defining User Commands: The DATA BASE MANAGER allows authorized users to store any sequence of commands in an external file and repeatedly invoke them in an easy and efficient manner. This facility allows even further customizing of production operations without the need for repeated entry of long sequences of commands.

The Data Dictionary

This component of the DATA BASE MANAGER consists of a collection of structured Data files (a Data Base) designed to provide centralized quality control over each application Data Base accessed by The DATA BASE MANAGER. Some of the facilities provided by the DATA DICTIONARY are:

Description of all Data files in the User Data Base.

Definition of all Data items in a Data Base and all the characteristic of each Data item.

Definition of all checks made by the DATA BASE MANAGER on each Data Item each time it is entered or modified in the User Data Base.

Description of all staff members authorized to have access to the Data Base and the type of access each can have.

A set of UTILITIES which allow the Data Base Administrator to closely control all activity on the User Data Base and prevent any problems from occurring.

The Data Dictionary is designed to play an active role in system wide Data Base Administration by providing extensive quality control monitoring and communication facilities to all system users and all active application packages. When used effectively by the Data Base Administrator, this tool should greatly enhance the integrity of all application Data Bases.

On-line Reports

This subsystem provides the GIS users with immediate access to the data base using a variety of report formats. The On-Line reports are used extensively by the Development, Alumni, Business, and other offices across the campus as an integral part of their daily routine. They are used to query the data base, locate a record or group of records in seconds, and display the appropriate information on a remote terminal in a variety of formats. Alternatively, they can use one of the remote printers available in many offices to generate a hardcopy printout, if that is more appropriate. Daily status and summary reports, donor inquiry reports, account status reports, donor acknowledgements, accounting reports and many others are generated daily in this fashion. One of the more powerful facilities in this subsystem is the interface between the data base and a commercial word processing subsystem. The integration of these two technologies in the GIS system opens a wide range of possibilities for fund raising work, the benefits of which we have only begun to reap. Using the word processing interface a user can specify a set of complex criteria which are used to select records from the data base. A body of text, such as a letter, can also be prepared, with pointers in the letter specifying where data from the selected records can be inserted. The system then will select the appropriate records from the data base and will generate one copy of the text (letter, donor acknowledgement etc.) with the appropriate data inserted in each letter. Using typewriter quality printers locally, many offices are currently replacing stand alone word processors with this system, realizing significant efficiencies.

Batch Reports

In order to optimize hardware and human resource utilization, some of the reports are generated in batch mode. These are generally reports that are not needed immediately or require a full data base search. The batch reports may be generated upon request with a minimum 24 hour turn around time, or may be scheduled and produced on a periodic basis. They may logically be divided into two groups. One includes programs that have predefined selection, sorting and formatting capabilities within certain limited parameters. The other includes programs that provide limited formatting options but can accomodate any selection and sorting combination possible within the data base structure. The latter reports are generated by a two pass process. The first pass uses a universal selection and sorting module which generates a file of pointers to the data base records that qualify for selection. In the second pass, the appropriate program uses the pointers to retrieve and format the records and produce the report. The users may, and routinely do, request reports with extremely complex selection and sorting requirements on an ad hoc basis. The Information Processing Center operations staff translates these user requirements into a set of selection specifications with minimum effort. A typical example of a selection requirement would be: "Select Donors that are not ON-HOLD, are flagged to receive mail or solicitations (or both). If an Alumnus is found and he/she lives or works in zip 94000-95199, print a label using the Alumni preferred address. If a Non-Alumnus is found and he/she either has a child attending Santa Clara or is a Regent/Trustee/Fellow Faculty/Staff, print a label using their Development preferred address."

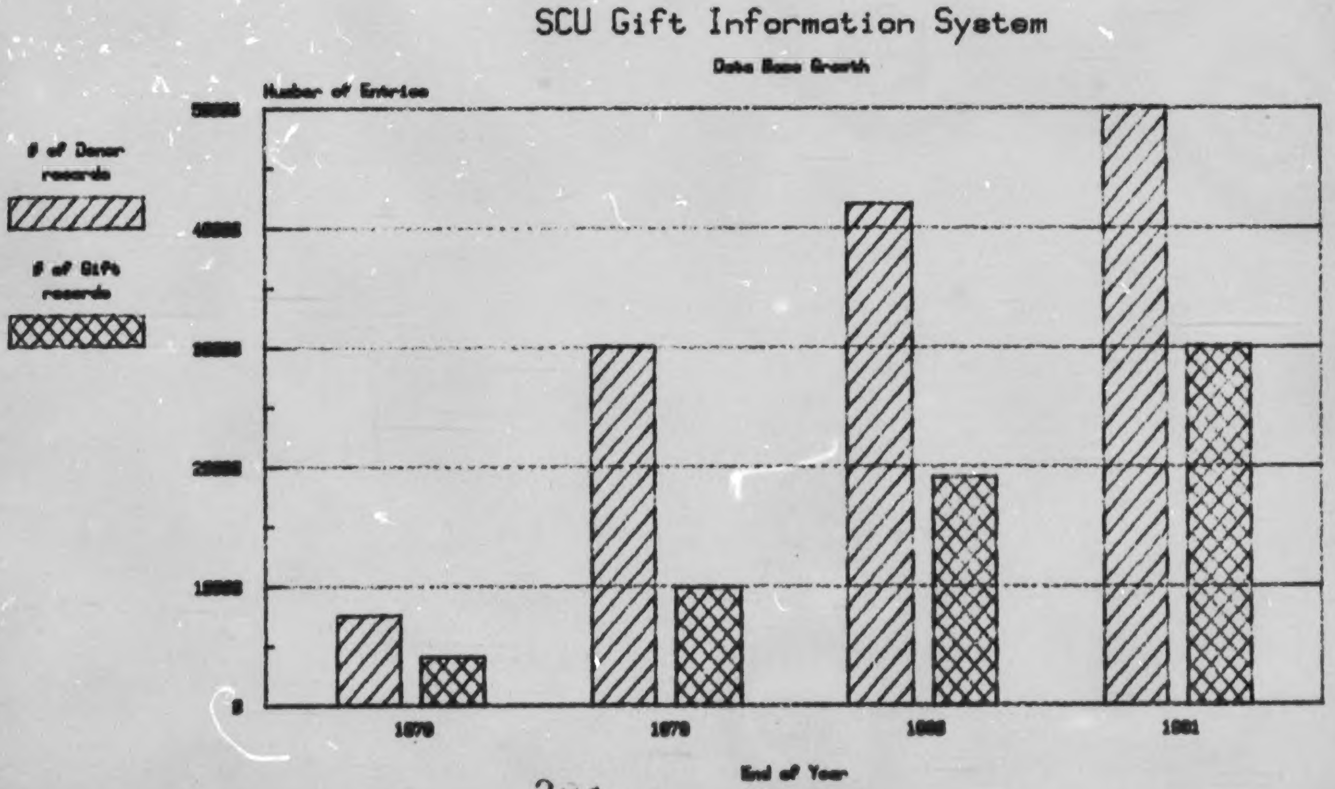
Conclusions

The system has been in use for four years with the present version just completing its first full year of operation. The user response to this latest version has been especially gratifying to the Information Processing Center staff. "GIS has been able to maintain a high degree of data integrity in the face of 1000% growth in less than three years..." says GIS Manager Monty Young who coordinates GIS related user activities in the Development office. The system also supports all mailing for fund raising and other activities (such as the News Bureau, the Theater and the Art Gallery mailings). Since all these mailing lists have been integrated and an enormous duplication of effort has been eliminated, the Campus Post Office is experiencing direct and significant benefits from the system. Bob Couture, Director of Mailing Services, reported recently: "I am currently receiving mailing labels within 24 hours following a request and the accuracy is the best ever..." The accuracy is indeed at an all time high as the chart on the following page indicates, even in the face of significantly increased volume. The user community also is due a large part of the credit for the increased accuracy and effectiveness of the system. Presently they maintain online over 45000 Alumni and Non-Alumni records. Here is a sample of the system activity during the month of October 1981:

- 101 Batch reports - 25,000 transactions
- 480 On-line reports - 130,000 mailing labels

A significant measure of the effectiveness and accuracy of the system is that of the 130,000 items mailed through GIS during the month of October, only 300 were returned due to errors. This represents a significant improvement over pre-GIS mailings.

In October 1981 the University announced a major Fund Raising Campaign to help increase its endowment and carry out several important building projects. The GIS system is expected to play a major role in supporting the campaign activities. It will enable the campaign staff and volunteers to utilize their resources with maximum efficiency. According to Gene Gerwe, Vice president for University Relations at Santa Clara and a major force behind the development of the system, the GIS system "makes all our fund raising activities more efficient and easy to manage. It has proven itself to be a useful system for collecting data for both past and prospective donors and making it available in a timely fashion to fund raising staff and volunteers. It is a management tool that is crucial to the success of our $50 million fund raising campaign..."



THE COLLEGE AS A KNOWLEDGE ORGANIZATION

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The organizational structure of a college should reflect actual working relationships and roles. Those roles and relationships result from the people and technologies the college uses to accomplish the institutional purposes. In a knowledge organization, the purposes involve the capture, storage, manipulation, retrieval, display and transmission of information. Word/text processing, electronic mail, video and optical disk, micrographic, telecommunication and other related technologies offer the small college excellent opportunities to increase effectiveness and control costs in a people-intensive enterprise.

By their nature information technologies call for total system solutions that tend to cut across traditional administrative lines. An organizational model is recommended that places under one cabinet level administrator all the information/communication functions of the college, including the library, registrar's office, instructional media, phone and mail services, internal and external institutional research, plus the MIS and data and word processing.

America has always had colleges. Even while the spartan conditions of early colonial life still made each day an adventure, the settlers of this nation began to develop residential centers of higher learning. The industrial revolution which was already underway in Europe had to wait for the agricultural base to be established in the new world. Thus, the early American colleges focused on the preparation of professional leadership for the church and state in an agrarian context. The purposes of such institutions must be understood in terms of the environment in which they function.

As industrialization began to flower in the United States, colleges continued to proliferate and many attempted to modify their purposes and programs. Most of these private institutions were not able to respond rapidly enough to their changing environment, and an entirely new sort of higher education institution began to emerge. These new institutions reflected the demands of an industrialized society for trained specialists to maintain an adequate rate of increase in agricultural and manufacturing production. The Morrill Act greatly accelerated this process with the establishment of the land grant institutions to promote the liberal and practical education of the industrial classes. These colleges combined concern for agricultural production with pragmatic responsiveness to the needs of an industrialized society. Colleges and universities came to be viewed as the source, not only of properly regimented and trained workers, but also the source of the knowledge which would enable both agriculture and industry to achieve increased productivity.

A college always defines its mission within the framework of some conception of its environment. Although the mission of an American college has always been related in some way to knowledge and learning, these purposes have taken myriad forms and expressed a wide variety of additional emphases. Those colleges which constructed an accurate concept of their environment and responded effectively to significant human needs have tended to survive. Many have failed to do so and have passed from the scene. The historian Frederick Rudolph estimates that 700 colleges tried and failed before the Civil War. About 250 existed at the start of the war, and 180 of those still survive. Unless a college can demonstrate the ability to meet the real needs of people in its environment, it cannot expect to attract either the interest of students or the support of donors, and without a steady flow of these vital primary resources, it cannot long exist. What does all this have to do with you and your computers?

Most of us have to spend our time and effort trying to get this morning's task finished in order to prevent today's problems from becoming next week's disaster. We live under the tyranny of the urgent, always aware that we can barely complete a system before it is obsolete, and that we can only add solutions while the problems seem capable of multiplication. But for just a few minutes let's leave the wagon stuck in the mud and climb to the top of the hill where we can catch a glimpse of the world that lies beyond.

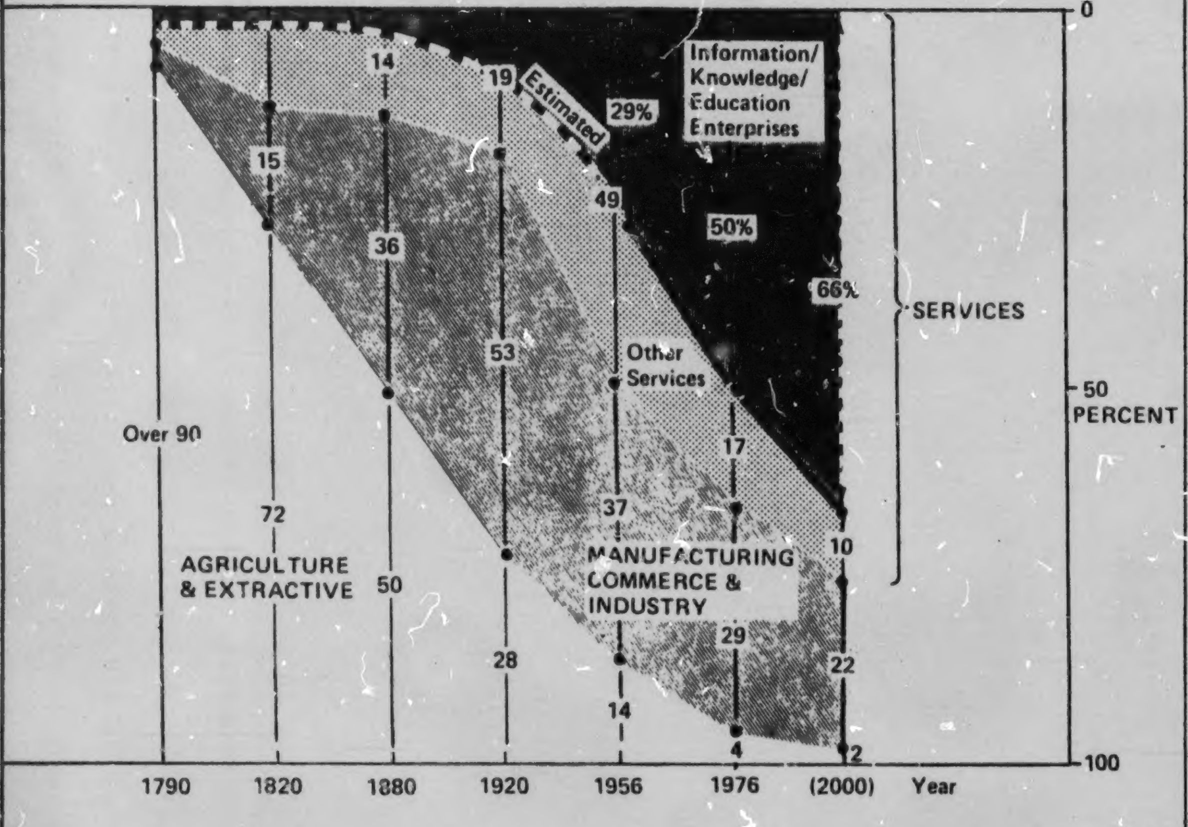
Let's try to imagine what our colleges will be like in the world that is coming. Then let's come back to take a look at the role that we need to fill in order to ensure that our colleges do seek out a significant purpose for themselves in the drastically altered context of the post-industrial world which even now is already hard upon us. Let's step back and take a long view of the college as a knowledge organization in a high technology information society. What will it do? How will it be organized? What role will it play in society? What role will you have?

Figure 1 is an excellent summary of what has been happening in the distribution of workers in different sectors of the American economy. As the society has evolved from agricultural to post-industrial, we can see the steady decline of workers in the agricultural and extractive sector. The industrial revolution in America actually reached its peak back around 1920 when over 50% of the workers were employed in manufacturing, commerce, and industry. By 1976, more than half of the people in this country were employed in information, knowledge, and education enterprises, and were not directly involved in making, selling, or transporting physical products with intrinsic value. Instead, most were working with various information media including a lot of paper.

To put it another way, it is expected that by the year 2000, about one fourth of the population in this country will be engaged in growing, extracting, making, selling, or transporting physical objects for their livelihood. About two-thirds will be engaged in creating, teaching, learning, storing, organizing, retrieving, or otherwise using information and ideas. Writing in The Futurist, April 1981, Graham Molitor stated, "The production, understanding, and control of knowledge have become essential, especially in the advanced nations. Knowledge and information industries are fast becoming the decisive factors in the growth of the productive forces of nations." In the January, 1981, issue of CAUSE/EFFECT, Gillespie and Dicaro made the following comments on the proposed

FIGURE I

POST-INDUSTRIAL SOCIETY WORKFORCE DISTRIBUTION:
Dominance of Information/Knowledge/Education Activities



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Information, Science and Technology Act of 1980.

> As the U.S. continues its rapid transition from an economy based on industrial production to one based on the transfer of information, the real source of political and economic power becomes information and the ability to access it quickly and reliably. . . . The power of information, of what we know to make decisions rapidly and accurately, rather than raw nuclear capability, is now the crux of our political strength. Our lives are controlled by what we know and by the information available to us. . . . Knowledge has become the central economic resource of our post-industrial society. Our major capital stock is no longer physical equipment; it is our body of knowledge and the ability to train citizens to use information effectively.

What is a society like that is dominated by knowledge, information, education, and communication? In short, it is characterized by the well-known advertising tag line, "Machines should work--people should think."

People ride around in some sort of personal conveyance machine. The machine is assembled largely by robots which are controlled by computers. Both the robots and their computer controllers were developed largely with computer-assisted design and development technology. The robots in turn are assembled by other robots in a plant that receives components which were made by robots from raw materials produced by an automated extractive and refining plant. People do very little making of things in such a society apart from the things they make for their own consumption. Rather, machines makes things, including other machines, while people spend their time working with information about the machines and the products they make. Indeed, the word manufacturing should be replaced by a new word, "mentafacturing." Manufacturing comes from two Latin words that imply making with the hands. In the world now upon us, we make things with our minds. I will not linger on the theological implications of this lofty view of mankind, but the "mentafacturing" world will certainly provide a dramatically different environment for our colleges in the future.

Most common transactions will be conducted electronically including shopping, banking, and communicating. Many people will be able to complete their work responsibilities entirely from their homes. Each home will have an electronic communication and computer center or "comcenter." The comcenter will connect each individual not only with other people, either vocally, or in print, but also with any information that exists anywhere in that vast network. Standard, static information will be available to him from his own inexpensive video disks. One side of one such disk will contain an entire encyclopedia, and four or five additional disks will contain all the knowledge a person is supposed to have available to him from a standarized core curriculum of the first twelve grades of school.

From the same comcenter he will access current information to meet any of his needs. If he is experiencing health problems, complete and up-to-the-minute diagnostic and prescriptive medical information is available to him, just as it is available to medical professionals. If he needs legal information, he obtains accurate and easy to understand assistance from the legal advisory data base. If he has the blahs, he can dial up a multibranching computerized therapy sequence which will help him sort out the causes of his emotional distress and put him back on track. To send a letter to his parents, he simply types or dictates into his center, addresses it to his parents and moments later his message to them is waiting in their electronic mailbox. If he needs to purchase something, he calls up the videotext yellow pages which enable him to identify the vendor with the specific product at the price and quality he desires. His comcenter allows him to order one for pickup or have it delivered. The item will automatically be charged against his current bank balance. If he wonders what that balance is, his center enables him to examine his current financial condition including his various investments.

In summary then, by the turn of the century, less than twenty years from now, most of us will earn a living by thinking and communicating our ideas, with almost unrestricted and instantaneous access to any information on any subject we desire. There will still be a lot of books, but they will be declining in importance as a communication medium. Printed magazines will be even less common. The information magazines contain will be available faster and cheaper at the home communication center.

The comcenter becomes the functional center of the home. From it people will work, shop, communicate, learn, and be entertained. From it they will be able to express their opinions, track the voting records of their elected officials, and cast their vote to elect the leaders they prefer. By the turn of the century, children raised in this intelligent environment will not tolerate educational programs which require them to store any knowledge in their brains which simply duplicates knowledge available to them from their electronic knowledge systems. They will also expect college to provide them with the same access to the universal knowledge base that they will have grown accustomed to at home and in school. Indeed, they will make their college selection and complete application from a comcenter, either at home or at school.

In the days of the early American college, knowledge was restricted to the privileged minority and the college had a unique role as a knowledge organization in that setting. The high technology information centered society will contain a wide variety of knowledge organizations. Many of these will compete directly with colleges. The purposes of any knowledge organization revolve around the creation, capture, storage, organization, manipulation, retrieval, display, or transmission of information. The important activities of a knowledge organization are thinking, communicating, discovering, evaluating, and planning. Technologies change over a time, but the current kinds of technologies prevalent in knowledge organizations include electronic data processing, word and text processing, electronic mail, video disk, microform, telecommunication, film and tape media, and good ole print on paper. The information society into which we are now moving is made possible by the increasing application of the electronic technologies.

One reason these technologies will come to dominate not only our society but specifically our colleges, is that they offer the opportunity to increase productivity and control costs in a people-intensive enterprise. The other important factor in their favor is they let us do things we could not otherwise attempt. When such technologies are adopted, changes occur in the ways organizational members think, act, and relate to each other. The college must have an appropriate organizational structure that will enable it to realize maximum benefit from the application of these technologies, while maintaining a clear vision of a significant societal purpose for the institution.

By their nature, information technologies call for total system solutions that tend to cut across traditional administrative lines of control. In the attempt to deploy the optimal arrangement of people, hardware, and software, both centralized and decentralized approaches can be used. Toffler (1980) suggests that centralization is one of the typical emphases of the industrial mindset. It emphasizes control from the top down, and seeks to gain the efficiencies often provided by standardized procedures and good internal coordination. In the centralized arrangement, the vertical line relationships are the ones that really matter.

By contrast, a decentralized approach, which Toffler claims is more characteristic of the high technology information society, depends upon the free flow of information to promote effective decisions that are made as close as possible to the point of implementation. Decentralized is not the same thing as disorganized, however, and centralized does not mean the same thing as autocratic. The best model for most colleges is probably a balanced mixture of centralized coordination and decentralized implementation.

The best organizational model would place all the information and communication systems of the college under one cabinet level administrator with a mandate to make them as integrated, efficient, and flexible as possible. This approach accepts the college as a knowledge organization in the context of a high technology information society. The areas normally included would be the library, the registrar's office, instructional media, phone and mail services, institutional research, marketing research, data processing, word processing, plus all operational and strategic management report systems. Pulling all the information and communication functions of the campus together under one coordinator should promote the comprehensive system solutions that colleges will need in order to remain competitive.

With so much information so readily available to everyone in the society, both the role of college and its curriculum will change. The important skills will center around knowing how to find and make use of information.

The faculty will have three main tasks:

1. Deciding what knowledge is most important for effective living.
2. Establishing the criteria for granting degrees.
3. Helping students think through value-laden issues.

The transfer of the basic information that used to be the professor's lecture notes will be accomplished by electronic systems of one sort or another. The teacher will become mentor, philosopher, guide, model, and evaluator. Contact with the teacher will begin in earnest after the student has mastered the necessary knowledge prerequisites. The focus will be on thinking, on wisdom, on using knowledge well, and on creativity. Many colleges will find it hard to maintain the residential character they now find so important because college will be only one place out of many where anyone who wants to can tap into the knowledge system. The college will have to keep up with everyone else, but it will not have the kind of "corner on the knowledge market" it has traditionally enjoyed.

There will be a terminal on almost every desk in the college--student, teacher, administrator, and staff. The terminal will allow access to any information on campus and off that is not restricted by law or official policy, and will connect that person with everyone else on the system for electronic mail messages. It will give him the electronic white and yellow pages if he needs to use the phone. Students and profs will compose their scholarly writings with the word processing capabilities, and send copies to others on the system as needed. Teachers will evaluate and comment on such paperless student "papers" at their terminals, record the grades in the electronic grade book, and, at term end, record the final grade and comment to be picked up by the grade collection program. Some colleges will automatically halt the electronic transfer of compensation to the bank account of any delinquent teachers. Some colleges will be providing a full range of electronic banking services to faculty and staff, finding that what they were obliged to provide for students was easily adapted to meet other needs. Student expenditures for information services, food, books, electronic postage, and other items purchased on campus will be charged to their personal account.

Clearly a college cannot afford to move toward such a future by proliferating four or five kinds of non-communicating word processing units on campus, by building or renovating dorms and academic buildings without thought to communications lines and terminal placement, by tenuring professors whose main skill is the presentation of factual information in lectures, or by allowing everyone to do his own thing in purchasing electronic learning media. The college that will prevail as a knowledge organization in a high technology, post-industrial society will move purposely toward the creation of an electronically-integrated campus with as little paper as possible and with as much free access to as much on and off campus information as funds will allow. Such a college will be reducing the proportion of budget spent on people to do low level clerical tasks and increasing the dollar investment per person in information and communication technology. Such a college will reduce organizational barriers to the free flow of information and ideas by placing all these systems under one administrator.

That person's task will be to make the college the best possible high technology knowledge organization. The task will not be easy. Vested interests abound, from job protection to turf protection. Tradition lies heavily on our institutions, a mixed blessing and curse. The registrar may not welcome the idea of having classrooms assigned by someone else using a master space audit. The librarian may not have as much fun dusting the video disk player as he did dusting the shelves of richly bound encyclopedias they replaced. Teachers may not know what to criticize in student papers if all spelling errors have been corrected by the word processor. Student deans may undergo premature mid-life crisis when the computer counsels better than they can. The academic dean may be in big trouble when he does not have to worry about libraries and registration foul-ups, but only about quality professors and a relevant curriculum. Academic departments may complain bitterly when their wonderful old secretary is replaced by terminals.

But we must all remember that the college is not just a knowledge organization, it is also an educational organization. It is a place where people learn about all those things that can never be captured on a video disk or stored on a floppy or organized in a data base. The college which succeeds in becoming a first-rate knowledge organization will preserve for itself the opportunity to press on with the greater task of building not just minds but spirits, not just data bases but a sense of meaning, and not just complete histories but compelling hopes.

A college will have to work very hard to keep the morale of its faculty and staff high during the demanding decades that will end this century. The new technologies will demand many new working relationships; old ties will be broken and new ones forged. Campus power will shift. If all those who must work together to create and maintain an integrated knowledge organization can feel that they are part of one unified and vital team, the adjustments can be made and your college can do more than merely survive, it can prevail. Some will ask whether a small college with limited funds can accomplish this immense undertaking. You can because you must. This is a wave that cannot be stopped. Not everyone will catch it, and those who do not will not reach the beach before dark.

I recently sat in the office of a college president who was going over some consulting reports with me. As we ended he rose and stared out his window for a long silent minute. Without turning to face me he said that his college was trying hard to respond to all the market and technological and economic changes, and because they had gotten an early start on it, he had some reasonable hope of success. He turned then and asked with genuine concern in his voice, "What about all the others who have not even started yet?"

When we leave here we will all be down off the hill, and back trying to get that wagon out of the mud. I hope that we will accept responsibility of leadership in our service. And I hope we can help shape and prepare our colleges for the world just beyond the hill.

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A DECISION SUPPORT SYSTEM FOR SMALL PRIVATE COLLEGE ADMISSIONS

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Abstract

A small North Carolina private college purchases a mini-computer with a data base management system specifically designed for small colleges. The system is found to be very useful for data base maintenance and for report generation. It is, however, slow and cumbersome when used for decision support. The college admissions office finds the system inadequate for support of individual admissions decisions, and the forecasting and simulation of enrollment. One of the authors is asked to design an interactive decision support system to utilize the established data base to answer "what-if" questions. A system is designed to support various decision types while interfacing with the data base, and operating on the same mini-computer. The paper describes the design of the data base interface, the different decision types supported, the nature and applications of the outputs of the system, and continuing work on extending the system. The decision support approach is found to mandate a system design substantially different from that imbedded in a report generation apporach to information systems.

A Decision Support System for Small Private College Admissions

The Admissions Problem

The admissions problem facing small private colleges has undergone dramatic change. Fifteen years ago, admissions staffs tended to be small and to do little actual recruiting. Some colleges might receive five times as many applications as there were spaces available. As a result, the colleges had little problem with maintaining enrollments, or if they chose, with maintaining the academic quality of student bodies. Since then, a number of factors have combined to change the picture. Among them are changing attitudes about the necessity of a college education, shifts in population age distribution, and cost increases which have necessitated substantial increases in tuition to keep colleges solvent.

If a college could anticipate a flow of early applications well in advance of a single decision point, the admissions problem for a college enjoying an adequate supply of candidates could be reduced to over-admitting by a carefully calculated allowance. Under normal circumstances, however, applications flow in over a period of months, extending into July and August. Since the subject college does not have monopoly on applications, delay in admitting a satisfactory applicant may result in the effective withdrawal of his application by his accepting admission at some other institution. Premature admission of a marginal candidate may result in lack of an opening for a more desirable candidate applying at a later date. Under these circumstances an effective approach to admissions must permit management of the process in its truly dynamic context.

The model described herein incorporates this dynamic characteristic of the admission problems and is intended to permit balancing of the financial and academic aspects of admissions decisions.

The college admissions process for selecting a freshman class from a pool of applicants may be considered a sequential decision process with predefined starting and stopping points. Beginning in January of each year and continuing through August, admissions officers make a series of individual admit or reject decisions until sufficient applicants have been admitted to "guarantee" reaching a previously set target for Fall enrollment. Each individual decision necessitates considering two aspects of the admissions process. First is the impact of each admit or reject decision on the likelihood of achievement of the enrollment target. This involves interaction with the decisions made concerning other applicants. The other part is the decision as to whether the individual applicant has sufficient likelihood of academic survival to be admitted to the school.

Most colleges will use some sort of predictive index for assessing the quality of individual applicants. Estimating the impact the single admission would have on the size of the freshman class is a more complex, but still important problem. The crux of the problem is that at any given decision point during the process, a school must decide how many of a relatively small sub-set of applicants to admit, simultaneously balancing financial and academic considerations, without knowing the number or quality of applicantions which might come available for review in the future. This also requires an estimate of the number of accepting students who will subsequently choose to enroll.

The remainder of this paper describes a decision support system which incorporates a forecasting and simulation model developed for Guilford College--a small, private, liberal arts college which has survived the enrollment crunch well, but which is constantly seeking new methods for enhancing the enrollment process. The construction of any forecasting-simulation model first requires a detailed analysis of the process to ensure accurate representation in the model. The admissions process, upon closer examination, has several unusual aspects.

The ultimate goal of admissions is a freshman class of a size which meets the policy goals of the college. (For the sake of brevity, we shall not consider transfers and returning students here.) This freshman class is, however, made up of several hundred individuals and must be assembled, one individual at a time, over a period of eight months. Complicating the problem is the fact that while the college has one opportunity to accept or reject a potential student, the applicant has numerous opportunities right up to registration day to decide against the college. Adding further complications are the lags in the process caused by the necessity to communicate by mail with potential students and to allow them reasonable time to make their acceptance decisions.

Guilford College acquired a PDP-11 mini-computer and the WISE DBMS (a DEC package) in 1974 and began using it for admissions processing the following year. The information available from the system, however, was found to be cumbersome and unwieldy when applied to the dynamic environment of the admissions decision process. A decision support system (DSS) was developed to support the admissions management process, drawing from the data based provided by WISE and giving the admissions staff the capability to forecast and simulate enrollment. At any point in time between January and July, the admissions DSS can forecast September enrollment taking into account historic flow patterns, response rates, time lags, and the year-to-date experience. The forecast is in the form of a probability distribution allowing the admissions director to evaluate his confidence in the forecast. In addition, he may test the effect on the forecast of various proposed policy decisions. Because of the flexible design of the interface with the primary data base, the admissions director could use the WISE sorting capability to generate summaries, forecasts, and simulations for any subset of applicants. The data required for the admissions DSS is selectively extracted from the main data base and stored in separate files. The admissions director may then run two programs which draw from the special DSS files. One summarizes how the admissions process has been managed to date. It tells him the rate at which the office has processed applications, the acceptance rate, and the various response rates--all broken down by two week periods. The forecasting and simulation program tells him expected enrollment if he continues his present policies and allows him to test the effect on enrollment of certain changes in policy.

The Admissions Process

The decision to admit or reject any particular applicant has two parts. One part is the effect the admit or reject decision for the applicant will have on overall goals such as the enrollment target. This part depends upon the decisions made concerning other applicants.

The other part is the decision as to whether the applicant, independent of the others, is of sufficient quality to be admitted to the school. Let us examine these.

The first part, the overall goal of the admissions process, can be described as reaching some desired level of enrollment consisting of students who have the capability to successfully complete college level work. Because the admissions process involves uncertainty, admissions decisions may generate results containing errors. Two types of error relating to the enrollment may occur. One is insufficient enrollment, caused by admitting too few applicants. The other is excessive enrollment caused by admitting too many applicants. The loss function associated with these errors is generally not symmetrical. In this context loss is used in the statistical decision theory sense for illustrative purposes, not as the basis for a formulation of the problem. If a college makes admissions decisions which it believes will lead to a desired freshman enrollment of $\underline{f}^*$, but the actual freshman enrollment is $\underline{f}$, then it suffers a loss which is a function of $\underline{f}$ and $\underline{f}^*$. Loss may be defined in monetary or other terms. We should point out that our perspective is that of a college administration. There may be very real costs to an applicant who is rejected for admission, but we shall not consider them here.

The shape of the loss function is a function of the marginal revenue for each student (equal to the tuition and fees paid by that student), while the marginal cost of enrolling that student is virtually zero within a certain range. In other words, if $f<f^*$, the College loses the tuition from underenrolling but still has a faculty and plant sufficient for an enrollment of at least f^* students; on the other hand, if $f>f^*$, the College gains the tuition and fees without incurring significant additional costs (as long as $f<f$ max). When $f^*<f<f$ max, there are some additional minor costs (supplies, etc.), but most of the loss is not measurable, e.g. the dissatisfaction caused by overcrowding in classrooms and dormitories.

The second part of admissions decisions, the goal of quality in the student body, conflicts with the total enrollment goal. If quality were the sole goal, only the single most qualified applicant would be admitted; if enrollment were the only goal, no applicants would be rejected until enough applicants had been accepted to insure that the ideal enrollment would be reached and all would be rejected thereafter. Three types of error can be made regarding quality. One is to admit a student who is not capable of performing college level work. The loss function is not so clear as in the under-enrollment case. Even if an unqualified student is admitted and enrolled, the college gets the tuition and fees from the student for at least one semester. Most of the costs are in the form of lower faculty morale, the need for increased remedial work, and replacing student attrition. Another error is to reject an applicant who is capable. In this case, there is a loss from the college's point of view only if the slot in the incoming class which would have been filled by that applicant must be filled with a less qualified applicant, or if the slot remains unfilled. The third type of error is to admit an applicant early in the decision process at the cost of having to reject a more qualified applicant later on because of the enrollment constraint.

The admissions process is treated as a series of individual decision points throughout the eight month "admissions season." At each point decisions are made on all applicants whose files are completed that time. In practice, the decision making process may be continuous. However, at various points in times (corresponding to the model's decision points), standards for admissions may be reviewed and modified and the set of completed applications is processed, resulting in a set of "admit," "reject" or "hold" decisions. Since placing an applicant on "hold" simply delays the admit-reject decision, it is not treated as a special case.

If an applicant is accepted, control of the process passes out of the system to the applicant. He has the choice of responding with a tuition deposit to insure himself a place in the entering class, of formally rejecting the admission, or of not responding (which amounts to a rejection). Some leakage from the system is still possible if the indicated enrollee fails to register. If the tuition deposit is high enough, this may not be a significant problem.

Operation of the Model

The operation of the model may be described by assuming some point in the admissions year, in this illustration period four. (The procedure itself does not vary with the time period.)

The high quality data base is essential to effective functioning of the model.

The WISE DBMS is an interactive system. Information may be entered continuously as applications are received, decisions are made, and responses are returned. The first task in using the DSS is to extract from the data base the relevant information about each applicant. The information we extract consists of the relevant dates (e.g. date applied, date accepted or rejected, and response dates), the index of predicted performance and the accept or reject decision. The computer system sorts and classifies the applicants, provides a summary for the admissions office, and stores the information needed for the forecast and simulation. The applicants are first sorted according to the two week period in which their applications were acted upon and also according to an index of predicted performance. A table is then printed for each time period up to the present showing (by predictive index) the number of applicants considered, the number accepted, the number paid, the number who have paid and withdrawn, the net paid, the non-responses, the net percentage of those admitted who have paid, and non-respondents as a percentage of admits. A table showing the totals to date is also printed. A set of these tables for each period provides a running record of progress during the year.

At this point, all the information necessary for running the forecasts/simulation has been loaded into the computer with one exception. The operator must enter the number of applicants the admissions staff has decided to admit from those currently under consideration. The first run generates the forecasts and requires no further input. The computer does not, however, just print a number which one must accept on blind faith. It prints out all the components of the forecast and a comparison with the policy parameters entered at the beginning of the admissions year. The first four components of the forecasts are individual categories based on the status of the applications.

The forecast for category one is made by adjusting the total who have paid downward to allow for those who will withdraw before registration. The number who are expected to not withdraw is the predicted number of the members of the incoming freshman class in category one.

In category two we are concerned with the number of members of the incoming freshman class who have been admitted but who have not paid a deposit. Several allowances are made in this category. One is the allowance of communication time--the time necessary to notify an applicant he has been accepted, and for him to respond. In the Guilford Model, four weeks are allowed to elapse before an applicant is expected to have replied. In addition, the forecasting model considers the applicants accepted according to the two week period in which they were accepted. This is based on the notion that an applicant who has not replied in eight weeks, for example, is less likely to reply than one who has not replied in two weeks. Once these factors have been taken into consideration, the computer generates a forecast for category two.

Category three is less certain. This forecast predicts how many of those currently under consideration will eventually enroll. The person using the simulation has already entered the number of applicants to be admitted, and this number is adjusted for those who are expected to respond negatively to arrive at the forecast.

Category four involves the most uncertainty because we are asking for a forecast of the number of members of the freshman class who have not yet applied. The basic technique used in the model is the comparison of an "ideal" flow of applications entered into the computer at the beginning of the process with the flow of applications this year. This comparison yields a prediction of the total number of applications for the year. This predicted total is adjusted for the admission rate, the response rate, and the number of applications already acted upon. The residual is the category four forecast.

To permit evaluating the uncertainty inherent in the forecast, the printout provides an estimate of "variance" in each category. The overall forecast for the size of the new freshman class is the sum of the category forecasts. This is also printed with an indication of the amount of uncertainty in the forecast. To give the admissions office an idea of how well the forecast meets the admissions goals, a set of comparisons is printed showing how well the goals are being met and how likely it is that final enrollment will fall within certain values. In other words, the admissions office is provided both a forecast and a statement of the probabilities of final enrollment being in various categories.

The final output in the forecast printout provides a link to the simulation or "what if" aspects of the model.

The computer prints out four numbers which have been used in making the forecast and which may be altered to test their effects. The four numbers are (1) the number admitted from the applicants currently being considered, (2) the overall percentage of applicants admitted so far, (3) the application flow rate compared to last year, and (4) the percentage of those admitted who pay and enroll. These four numbers would appear to reflect most of the policy alternatives available to the admissions director or the college. By altering these numbers and reviewing the model, the admissions director can test the potential impact of modifying these policies.

Field Testing

The initial field test was conducted on the Guilford College admissions process for the Freshman class entering in the Fall, 1977. Since the enrollment forecasting system requires a set of historical data for computing trends, and since Guilford's computerized data base only extended back to 1976, the initial test had to be limited to the 1977 entering class. This was not a serious limitation since it was possible to reconstruct the situation at each decision point and forecast the final enrollment as if one had no knowledge of the future. In fact, the forecasts for approximately half of the decision points were made at those decision points, and all were made before the final results for the year were known.

The field test centered around simulating the effects of changing each of the sources of variation. Retroactive forecasts were made for each period to test the accuracy and consistency of the forecasts, and simulated changes were made at each decision point to test the response of the model to these changes.

Despite the problems inherent in implementing a new system, the forecasting system was accurate within 1.5 percent of the actual enrollment. The next year ran much more smoothly and showed the same accuracy. The third year was the acid test--the constructor of the DSS went on leave and was unavailable for consultation. That year ran as smoothly as the previous year. The fourth year activity included the addition of programs and features to give the admissions director even more information transferability.

We have also designed the model with flexibility in mind--especially in the development of the computer programs. The model is structured around the admissions process, not around a particular admissions policy. In fact, the parameters which reflect admissions policy must be re-entered each year and thus must be re-evaluated each year. The model is also independent of the method used for evaluating individual applications, and even the two week decision period scheme may be changed to fit any particular situation. The model may also be used for different types of students such as traditional or continuing education.

Since programming is in the BASIC language, the simulation can be adapted to many main frames as well as most micro computers. If a computer is used in processing applications, adequate capability for creating the data base can be developed through a limited capability data base system or limited custom programming.

Where a comprehensive system such as WISE is available, custom programming is limited to developing the interface to permit the model to draw from the computerized data base. By designing the system around the admissions process rather than a particular policy, and by constructing the data base tie-in through an independent interface, we have developed a system which provides maximum flexibility and transferability.

Summary and Conclusion

The purpose of the enrollment forecasting system is to make an enrollment forecast to enable the decision maker to test a set of applicants at any point for feasibility with respect to the admissions policy goals. The system meets this objective, especially from the

April cutoff point forward when information about feasibility is of primary interest to the decision maker.

In addition to meeting the objective of testing for feasibility, the model also yielded additional benefits. The Associated Director of Admissions at Guilford, for example, already was able to predict final enrollment accurately using his intuition developed during eight years of experience. He showed great interest in the individual forecasts, however, because they contained information which was not ordinarily available to him (i.e. categories two, three, and four). The system also gives the decision maker the ability to simulate the effects of shifts in the applications flow rate to determine if action is needed, or to simulate the effects of policy changes with regard to admission rates or a shifting proportion of enrollments. Lastly, the use of an interactive computer system for the model means the Director of Admissions could conceivably have a computer terminal at his desk to test the ramifications of decisions as he makes them.

PERSONNEL/PAYROLL ENTITY-RELATIONSHIP MODEL

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Conventionally, user data bases are designed with a specific commercial data base system (IMS, ADABAS, TOTAL, etc.) in mind. The user data bases are often designed around the limitations of that system not the logical aspects of the data. This method usually leads to a user data base design that is highly dependent on the commercial data base package that is used and not easily movable to other packages. Even the logical relationships between the data elements do not represent the views of the entire organization only those of the specific data base system.

If a model of each of the core user data base systems could be created, new user data bases that are designed would have a basis to use as a starting point. It is hoped that this would allow user data bases to be designed in a lot less time due to the designers not having to start from scratch. More flexibility may be achieved if the core user data bases are designed without a specific commercial data base package in mind by using a general representation that may be adapted to any specific package's design specifications.

The entity-relationship design is a general method of describing a user data base without considering a specific commercial data base package. This paper will be used to establish a general Personnel/Payroll Entity-Relationship model that can be converted to a 'user schema' for several different data base packages.

INTRODUCTION

It has been suggested by several members of the Chicago Area Database Design Group [1] that there are a few user database models in existence and that every system currently in production is a variation of the core models. Some of the suggested core user databases are:

1) Financial / Banking
2) Student Information [4]
3) Personnel / Payroll
4) Item Tracking [3]
5) Manufacturing Parts List
6) Job Scheduling
7) Insurance
8) Library
9) Hospital Administration / Patient Information
10) Accounts Payable / Accounts Receivable

This leads to the idea that there is a lot of duplication of effort in designing user databases. Each user database designer starts from scratch and creates the database for the organization within which she is working.

The entity-relationship design is a general method of describing a user database without considering a specific commercial database package. This approach is described by Professor Peter Chen [2]. In brief, it is a means of designing an interface between the data 'real world' and the user database 'Enterprise Schema' because the entity-relationship design takes the objects of interest and describes them in relationship to the entire enterprise. Then, the enterprise schema is mapped to the user schema (specific commercial database package). Note that this is a two step approach; first, defining the enterprise schema and second, translating the enterprise schema into a user schema. The E-R design technique differs from the conventional approach to designing user databases which usually just map the data about the real world into a commercial database package.

Chen states the advantages of the E-R approach as follows: [2 pg 9]

1) The division of functionalities and labor into two phases makes the database design process simpler and better organized.

2) The enterprise schema is easier to design than the user schema since it need not be restricted by the capabilities of the database system, and is independent of the storage and efficiency considerations.

3) The enterprise schema is more stable than the user schema. If one wants to change from one database system to another, one would probably have to change the user schema but not the enterprise schema, since the enterprise schema is independent of the database systems used. What needs to be done is to remap the enterprise schema to a user schema suitable for the new database system. Similarly, if one wants to change the user schema to optimize a new application program one need not change the enterprise schema, but rather remap the enterprise schema to a new user schema.

4) The enterprise schema expressed by the entity-relationship diagram is more easily understood by non-EDP people.

By utilizing the user core database models, designers will not have to duplicate efforts in determining entities and their relationships which will allow them more time to concentrate on their specific needs rather than the general aspects of the user database they are designing.

This paper will be used to establish a general Personnel/Payroll Entity-Relationship model that can be converted to a 'user schema' for many different database packages.

PERSONNEL PROCESSING

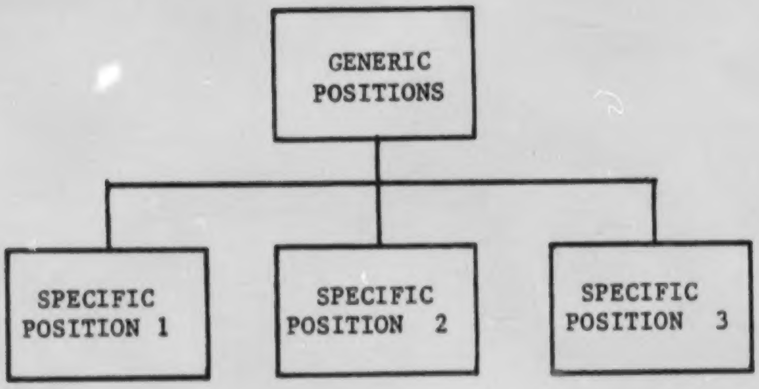
Personnel processing revolves around the skills needed by employees to occupy positions within an organization.

There may be a general category of positions (ie. application programmers) in which there are many specific positions to be occupied. The specific positions are those that are actually occupied, whereas a generic position is a general category that contains many specific positions. The specific within generic position capability would not necessarily be needed by all organizations. A relationship of positions to itself shows the hierarchy of specific to general (Figure 1).

Either or both the generic or specific position may have requirements that must be met by an employee in order to occupy a position. The requirements represent skills that are needed to fulfill the work to be done. Several entities and relationships are used to represent the requirements as shown in Figure 2.

When the relationship entitled EMPLOYEE occupies POSITION exists it shows that the position is filled. If there is no relationship node from a SPECIFIC POSITION to an EMPLOYEE, then the position is vacant.

Employees have skills prior to employment and they, also, continue to acquire skills during employment with the organization. The relationship (ie. years experience) between EMPLOYEES and SKILLS can be updated upon the anniversary date of employment. Thus the organization can have the ability to automatically keep track of an employee's skills to be used as a basis for promotions.



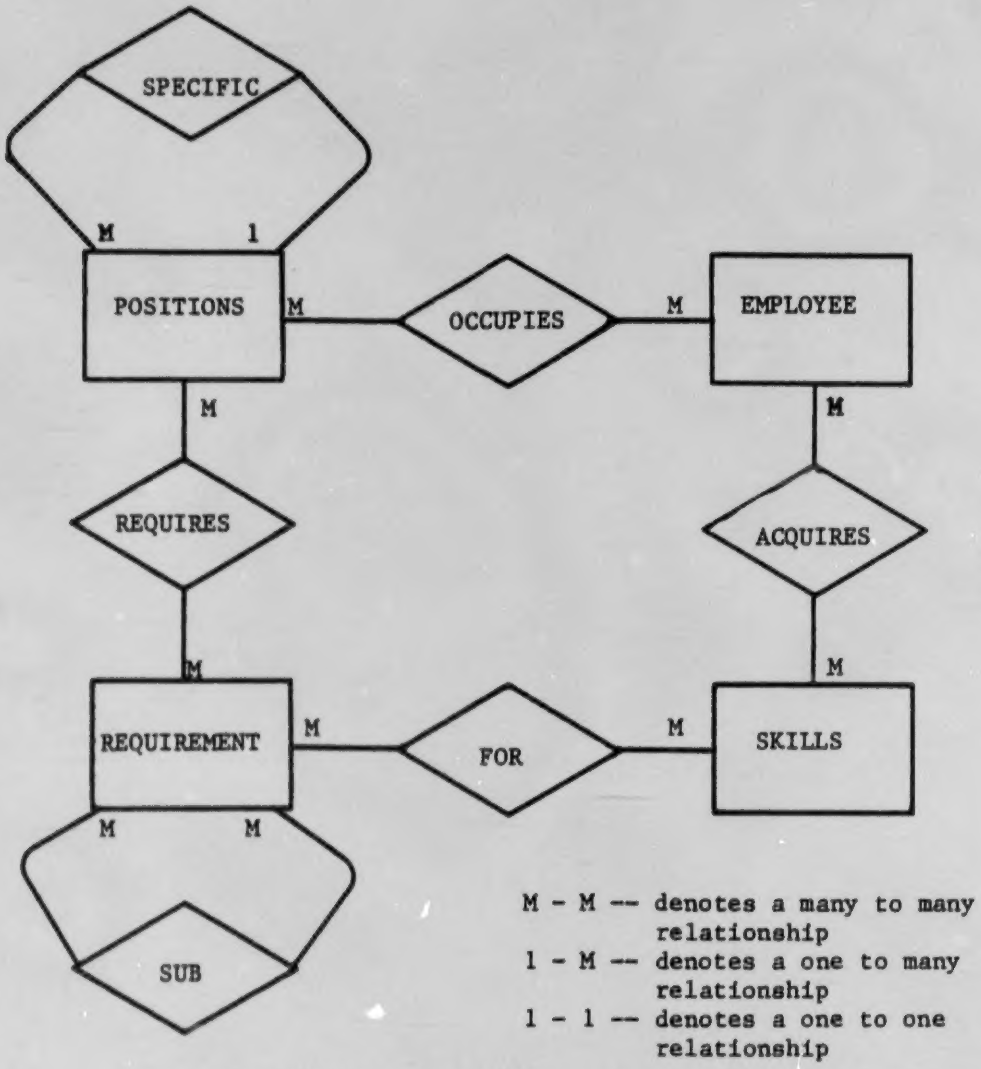
Hierarchical Relationship of Generic to Specific Positions

FIGURE 1

The REQUIREMENT entity represents the 'and' and 'or' conditions needed in specifying the skills required for a position. For example: If the following requirements were needed for filling a position,

> Three years data processing experience including one year of programming OR university training and experience totalling three years but not less than one year of programming.

they would be represented in the REQUIREMENTS entity as shown in Figure 3.


SPECIFIC
M
1
POSITIONS
M
OCCUPIES
M
EMPLOYEE
M
M
REQUIRES
ACQUIRES
M
M
REQUIREMENT
M
FOR
M
SKILLS
M
M
SUB

M - M -- denotes a many to many relationship
1 - M -- denotes a one to many relationship
1 - 1 -- denotes a one to one relationship

Employee, Skills and Positions and their Relationships

FIGURE 2

33~

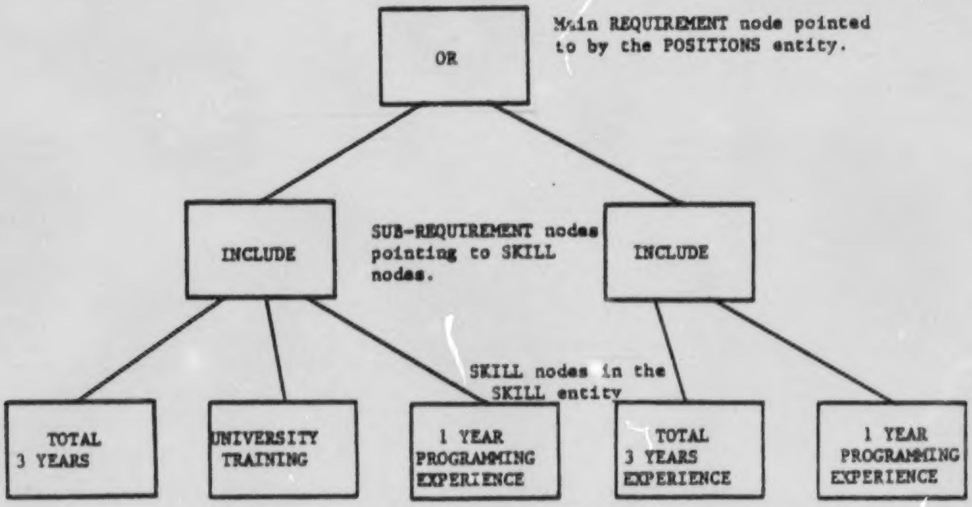
The REQUIREMENTS entity nodes could specify 'm out of n' of the following requirements are needed. This allows the implementation of alternate requirements or choices of requirements to be used for employment within a position.

An added complication can arise if employees are allowed to waive the requirements or substitute for an requirement. If it is necessary to keep track of the equivalents used by employees to waive requirements, the EQUIVALENT entity is added (Figure 4).

Specific positions are usually included in the budget of specific departments (cost center) within the organization. Employees work for or are in charge of cost centers which leads to the relationships shown in Figure 5.

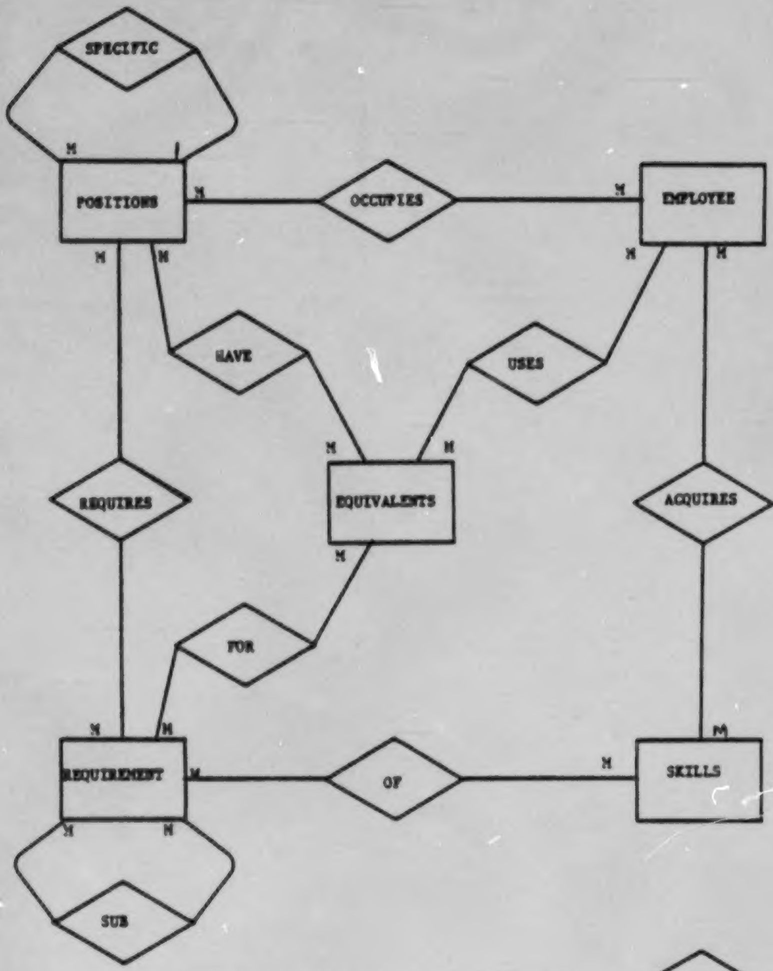
The EMPLOYEE entity may also include applicants for employment. The relationships set up to keep track of the skills required by employees to occupy positions may also be used to determine if an applicant can meet the requirements for employment in the position requested or in any positions within the organization.

Shared positions may also be a problem that can be easily implemented in this E-R model by allowing a many-to-many relationship between POSITIONS and EMPLOYEES.


OR
Main REQUIREMENT node pointed to by the POSITIONS entity.
INCLUDE
SUB-REQUIREMENT nodes pointing to SKILL nodes.
INCLUDE
SKILL nodes in the SKILL entity
TOTAL 3 YEARS
UNIVERSITY TRAINING
1 YEAR PROGRAMMING EXPERIENCE
TOTAL 3 YEARS EXPERIENCE
1 YEAR PROGRAMMING EXPERIENCE

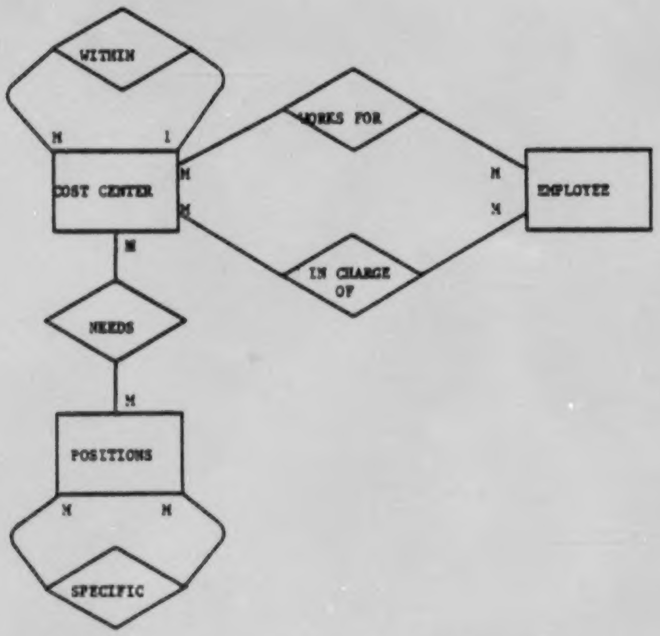
Hierarchical Representation of REQUIREMENTS Entity

FIGURE 3


SPECIFIC
M
1
POSITIONS
M
OCCUPIES
M
EMPLOYEE
M
M
M
M
HAVE
USES
M
M
REQUIRES
EQUIVALENTS
ACQUIRES
M
FOR
M
M
M
REQUIREMENT
M
OF
M
SKILLS
M
M
SUB

EQUIVALENTS Entity allowed for REQUIREMENTS

FIGURE 4


WITHIN
M
1
WORKS FOR
M
M
COST CENTER
EMPLOYEE
M
M
IN CHARGE OF
M
NEEDS
M
POSITIONS
M
M
SPECIFIC

COST CENTER's Relationship to EMPLOYEES and POSITIONS

FIGURE 5

PAYROLL PROCESSING

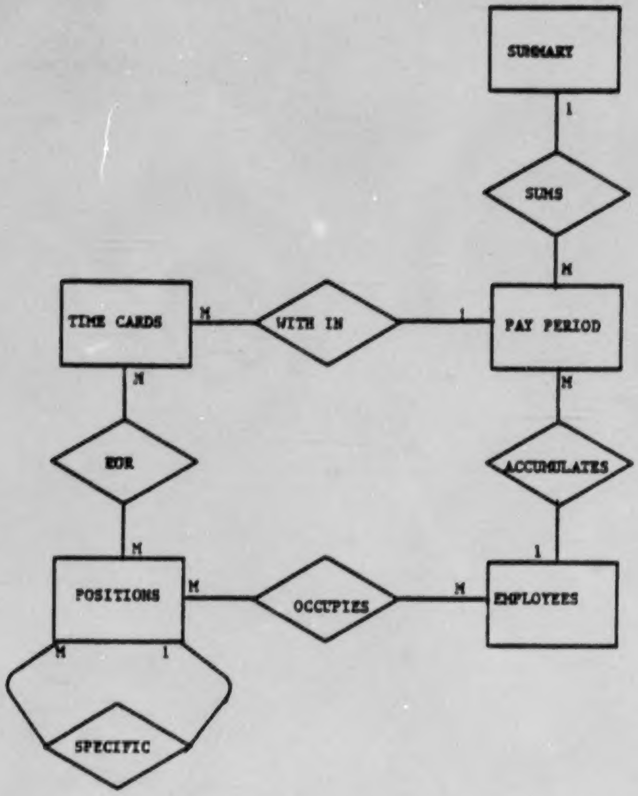
Payroll processing differs between different organizations. Some companies need to keep track of the amount of time an employee spends on specific jobs as the pay rate may be different depending upon the work being done at any one time. This can be represented by line items on the time card. These line items are directly related to the specific positions occupied at a time.

Other organizations only need to keep track of salaried employees. Basically, this is a single line item per pay period relating to a single specific position.

The line items on the time cards relate to the pay period in which they occur. There may be one or more line items on a time card per pay period depending upon the type of payroll processing in use.

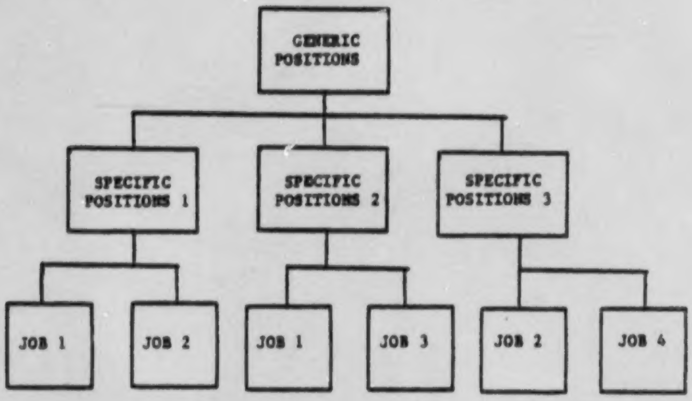
The employees relate to the pay periods by accumulating payment data for each pay period. Figure 6 shows the entities and relationships that are needed within payroll processing.

One thing to note about those organizations that must keep track of line items on the time cards for different pay rates is that the relationship between EMPLOYEE and POSITIONS changes. It becomes a relationship between employees and the positions that they could occupy during a work day. By utilizing the hierarchical relationship of positions to itself an employee could occupy a position which allows many specific jobs (represented by other positions). These separate jobs would then relate to the line items on the time cards (Figure 7).


SUMMARY
1
SUMS
M
TIME CARDS
M
WITH IN
1
PAY PERIOD
M
M
FOR
ACCUMULATES
M
1
POSITIONS
M
OCCUPIES
M
EMPLOYEES
M
1
SPECIFIC

The Relationship between EMPLOYEE, PAY PERIOD, TIMECARDS and POSITIONS.

FIGURE 6


GENERIC POSITIONS
SPECIFIC POSITIONS 1
SPECIFIC POSITIONS 2
SPECIFIC POSITIONS 3
JOB 1
JOB 2
JOB 1
JOB 3
JOB 2
JOB 4

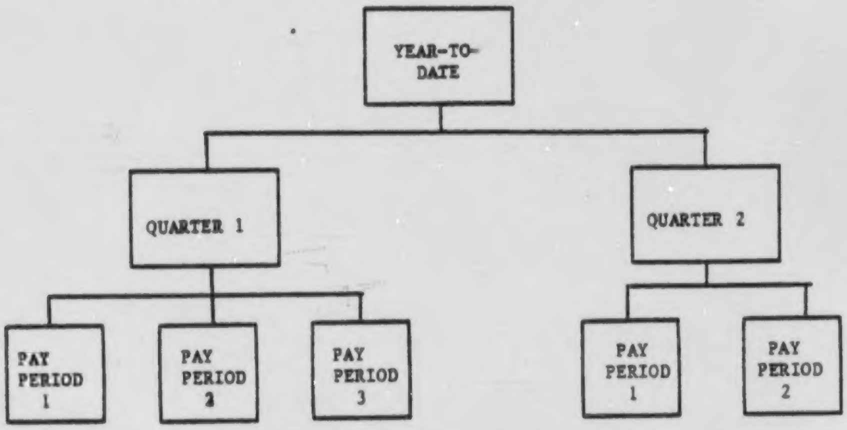
Hierarchical Relationship of Generic positions, Specific Positions and Jobs for Qoganizations that change pay rate based on the actual job being performed at any one time.

FIGURE 7

The relationship of SUMMARY to the PAY PERIODS entity allows quarterly and year-to-date information to be kept separately which may be convenient, even though it would be redundant, for the report processing that is required within a payroll system. (The quarterly information is redundant because it could be recalculated every time it is needed from the information in each individual PAY PERIOD.) The hierarchy of summary information could be noted as in Figure 8 where the lowest level information is kept as nodes in the PAY PERIOD entity.

When pay checks are issued to an employee, deductions must be made. The deductions are both mandatory (taxes) and voluntary (credit union, United Fund). The rules for what to deduct are particular to the the employee. An entity that represents the DEDUCTION with a relationship to the EMPLOYEE is used to denote the specific rules for the deductions to be taken from the gross pay (Figure 9). This is a many-to-many relationship to reduce the redundancy of the deduction's general information.

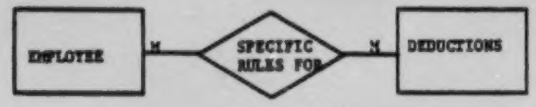
Checks are created from the PAY PERIOD information, the TIME CARD line items and the DEDUCTION rules. The check information can be considered a financial transaction. Such a transaction debits and credits certain general ledger accounts within the organization. Thus the FINANCIAL TRANSACTION entity is a summary of the check. The relationship between the transaction and the ACCOUNTS entity represents the line items (debits and credits) affected by the check along with the amounts.



Nodes after the Second Pay Period of the Second Quarter.

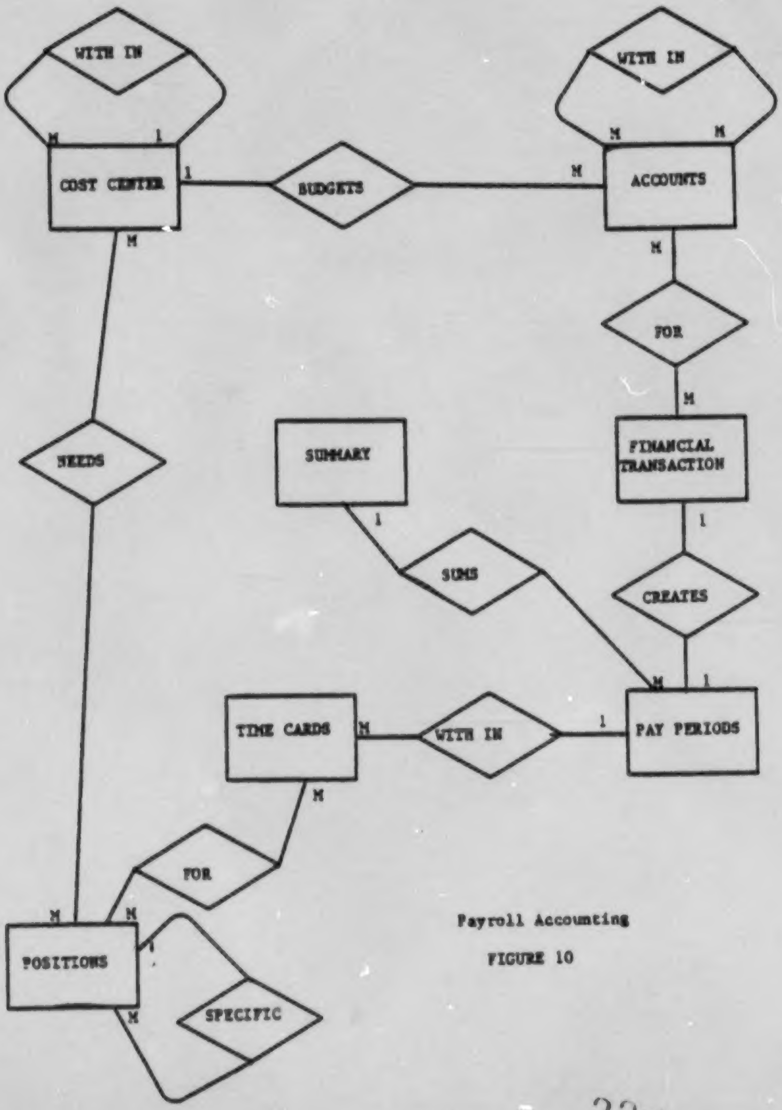
FIGURE 8

Figure 10 shows the accounts are related to the cost center through the budget. Each cost center has a line item in the general ledger accounts. The accounts are hierarchically related to themselves to denote higher level accounts.


EMPLOYEE
M
SPECIFIC RULES FOR
M
DEDUCTIONS

Relationship for DEDUCTIONS of Employee's pay.

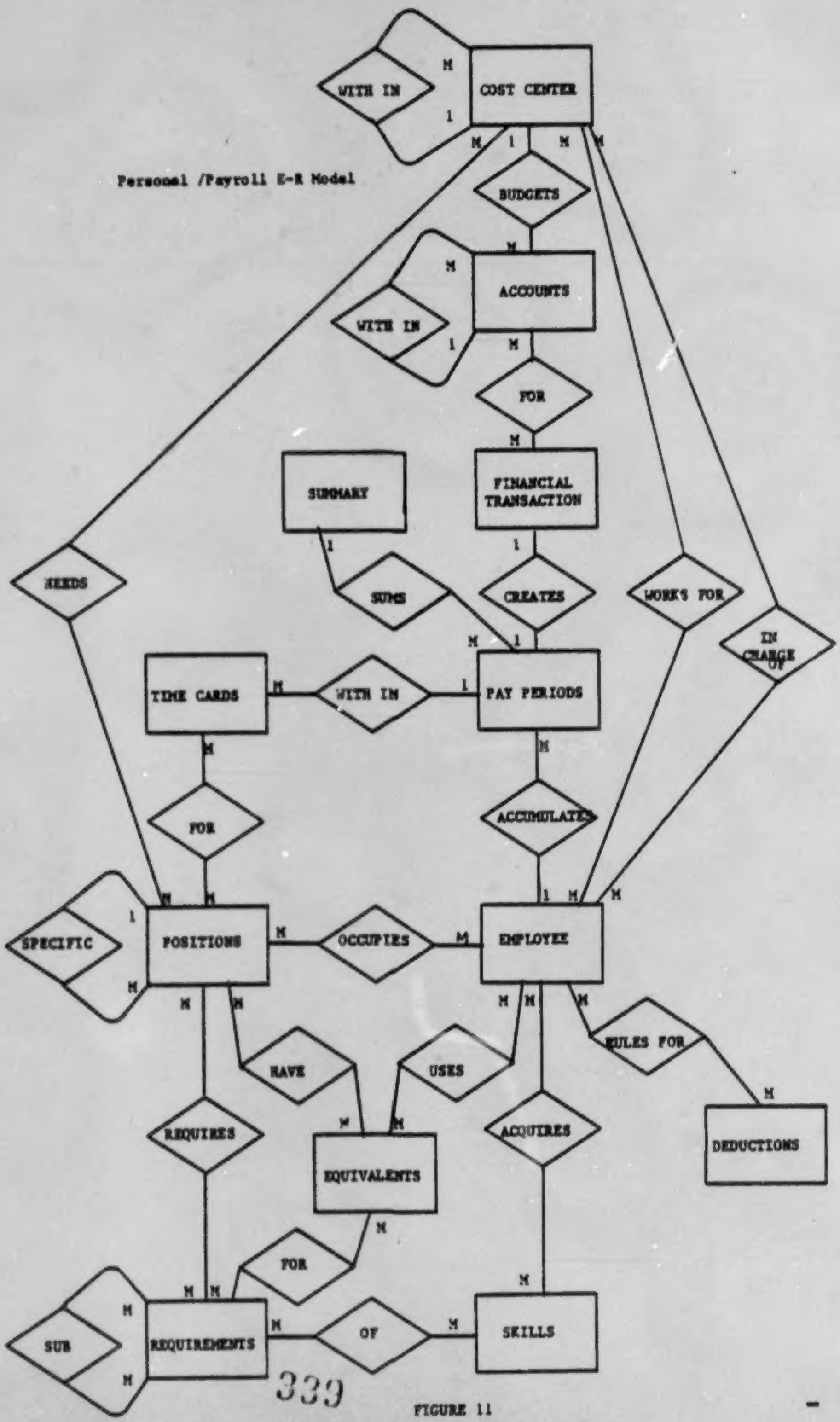
FIGURE 9


WITH IN
M
1
COST CENTER
1
BUDGETS
M
WITH IN
M
M
ACCOUNTS
M
M
FOR
M
NEEDS
SUMMARY
FINANCIAL TRANSACTION
1
1
SUMS
CREATES
M
1
TIME CARDS
M
WITH IN
1
PAY PERIODS
M
FOR
M
M
POSITIONS
1
M
SPECIFIC

Payroll Accounting

FIGURE 10

Now putting all the pieces of the Personnel and Payroll system together we have the complete E-R model shown in Figure 11.



Personal /Payroll E-R Model

COST CENTER
WITH IN
BUDGETS
ACCOUNTS
WITH IN
FOR
FINANCIAL TRANSACTION
SUMMARY
NEEDS
SUMS
CREATES
WORKS FOR
IN CHARGE OF
TIME CARDS
WITH IN
PAY PERIODS
FOR
ACCUMULATES
SPECIFIC
POSITIONS
OCCUPIES
EMPLOYEE
HAVE
USES
RULES FOR
REQUIRES
EQUIVALENTS
ACQUIRES
DEDUCTIONS
FOR
SUB
REQUIREMENTS
OF
SKILLS

FIGURE 11

REFERENCES

[1] Chicago Area Database Design Group meets once a month to discuss database topics. It is comprised of professors, consultants and data processing personnel who combined have many years experience in database applications.

[2] Peter Chen, THE ENTITY-RELATIONSHIP APPROACH TO LOGICAL DATA BASE DESIGN, Q.E.D., Wellesley, Mass., 1977.

[3] E.L.Lusk, G.Petrie and R.A.Overbeek, 'Item Tracking Entity-Relationship Models', ENTITY-RELATIONSHIP APPROACH TO INFORMATION MODELING AND ANALYSIS, Proceedings of the Second International Conference on Entity-Relationship Approach, (Washington, D.C., October 1981).

[4] Geoffrey E. Margrave and Kathi Ann Davis, 'Student Information Entity-Relationship Model', Proceedings of the 1981 CUMREC Conference (Miami, Florida, May 1981).

The Third Wave: Keeping One's Head Above Water

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Abstract

As the "Third Wave" of the "Information Society" comes sweeping over us, we must prepare our organizations for change. The sociotechnical systems model described in this paper is a useful one for analyzing the complexities of this change. It is useful not only as a descriptor of the many elements involved, but also as a tool for predicting the output of a subunit of the organization when specified inputs are changed. Like any model, it is limited and imperfect in the face of the rich variety of people and institutions. But it may help to make the process of organizational change more understandable, more manageable, and more sensitive to human needs. From 1976 to the present, John Brown University has converted from an institution where the highest form of technology was electric typewriters to one with a centralized Information Processing Center. The description of this change, in light of the sociotechnical systems model of analysis, may help other small institutions take the plunge.

For the small institution with high technology on its mind, there are a number of sources of help. Hardware and software vendors, consultants, and personnel from other institutions can provide valuable advice for avoiding pitfalls. John Brown University has benefited from many fine resources in developing its present Information Processing Center. A relatively neglected topic in the planning guides and a frequent cause of unexpected snags has been the human factor. Guides for computer system installation or expansion focus on data needs analysis, physical facilities planning, action planning for implementation, and systems design and testing. If people are mentioned, it is generally in the context of staff selection or training. Nonprofit organizations have special needs in this regard since their goals and traditions often transcend bottom-line fiscal objectives. While the budget is important, the loyalty and cooperation of people who are committed to the institution's mission are also important.

The purpose of this paper is twofold. First, it will briefly summarize a model of organizational behavior that is useful in assessing organizational settings and in planning change. Second, it will present John Brown University as a case study in applying the model to a small institution's experience in developing information processing systems.

Part I - The Sociotechnical Systems Model

The model is described in Systems Analysis in Organizational Behavior by John A. Seiler. (Irwin-Dorsey Series in Behavioral Science, 1967.) The advantages of this particular model are its comprehensiveness and its flexibility. Seiler's model is based on systems theory, which makes it conceptually familiar to data systems analysts. According to Seiler, the significant characteristics of systems underlying the model are:

1. Systems consist of numerous objects or forces and their relationships to each other.
2. Behavior of any one object in a system is the result of multiple causation.
3. Systems use feedback in seeking equilibrium; equilibrium is often dynamic and not necessarily optimal.
4. The same object or force in a system may be both functional for certain system objectives and dysfunctional for others.
5. Systems exist in an environment that imposes contraints on the system and provides it with choices.[1]

The components of Seiler's model and their relationships are depicted in Figure 1.[2]

Part II - Description of John Brown University Information Processing System

Some general background is necessary to understand the dominant characteristics of the John Brown University organizational system. The University is currently led by its third president, John E. Brown III, grandson of the founder. The founder was an individual of great vision and charismatic leadership. The second John E. Brown, the present Chancellor, took on the task of developing a strong fiscal base for the University. Most of the administrators through this second presidency had graduated from the University and served in varied capacities in the college throughout their career lifetimes. They were and are individuals personally committed to the institution who placed a high value on work and on economy of operation.

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[1] John A. Seiler, Systems Analysis in Organizational Behavior, Irwin-Dorsey Series in Behavioral Science, 1967, p. 21.

[2] Ibid., p. 33.

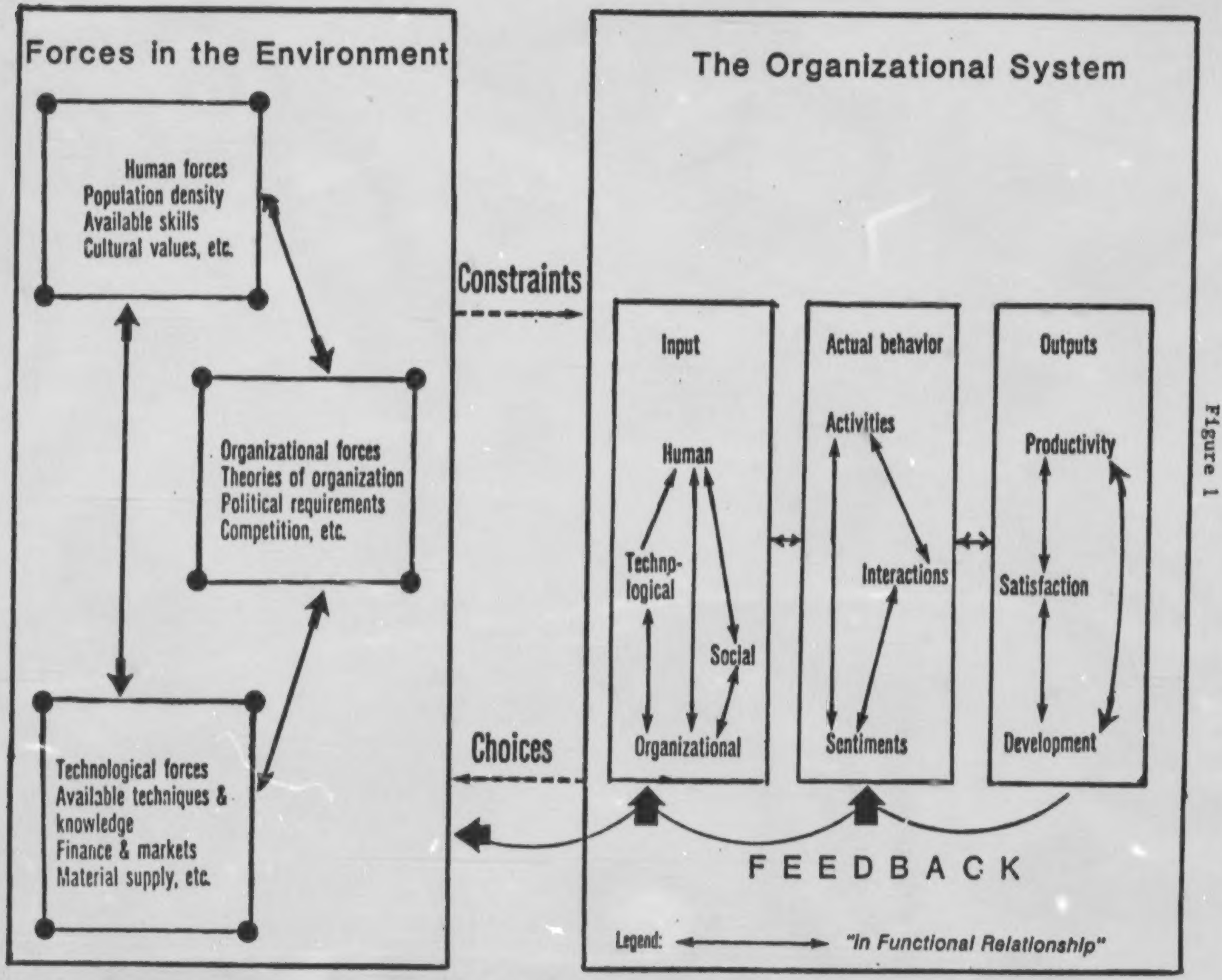
Forces in the Environment
Human forces
Population density
Available skills
Cultural values, etc.
Organizational forces
Theories of organization
Political requirements
Competition, etc.
Technological forces
Available techniques & knowledge
Finance & markets
Material supply, etc.
Constraints
Choices
The Organizational System
Input
Human
Techno-logical
Social
Organizational
Actual behavior
Activities
Interactions
Sentiments
Outputs
Productivity
Satisfaction
Development
FEEDBACK
Legend:
"In Functional Relationship"

Figure 1

In 1973, a new staff person was hired in the Development Office. This department included student recruitment, fund-raising, print operations, and alumni relations. Part of the new staff member's assignment was to study current operations and consider ways to simplify procedures. At about the same time, the third John Brown completed law school and moved into an executive vice presidency. An administrative building was being planned which would involve relocating and centralizing a number of scattered offices. At this time, twenty-two staff members worked in the Development department.

The new staff person initiated a review of current operations. It was discovered that gifts received by the University passed through seven different offices, each of which collected information about the gift. This was just one example of redundancy in the system. There had been no significant prior effort to systematize information flow from an institutional perspective. This study resulted in some streamlining of operations and the eventual reduction to fifteen, and later ten, staff members in Development. The financial savings were welcomed, but top administrators remained resistant to proposals that would centralize operations further and alter existing patterns of control.

In 1976, a typist with exceptional skills was hired. The Development Office took the opportunity to offer letter-typing services to other administrative departments. This offer was gradually accepted. Productivity was doubled with the purchase of a more advanced typewriter which used magnetic cards. Realizing the potential for further improvement of the service, the Development Office began investigating word processing equipment. This was not supported by the administration at the time because of the perceived high cost of equipment. In addition to the cost, the reliance on "outside" technology over "inside" University people went against the grain.

In 1977, conversion to a true word processing operation was accomplished. A document printer was added which more than doubled productivity to 500 original and form letters per day. The administrators visited the word processing office of another college. The efficiency of the operation and the prospect of reducing secretarial staff broke the resistance. Immediately a dictaphone was ordered and word processing equipment investigated. The staff person who had initiated much of this activity proposed an IBM Office System/6 which would perform file storage functions. It would eliminate an existing address printer, interface with existing equipment and manage records for both Development and for the Registrar. Enrollment reports and rosters which had consumed three weeks of staff time could now be produced in an afternoon.

The planning for the purchase of word processing equipment involved the first real information system analysis. Flow charts were developed to plan data collection and use from student recruitment through enrollment and into the Alumni Office. At this time a federal grant project supported campus-wide analysis of the information system. A consultant funded by the grant was involved throughout this period in information system planning. Administrators and managers in each functional area were interviewed regarding office procedures, forms, and data needs.

The success of the Office System/6 prompted thinking of further progress through purchase of a computer. Much of the resistance to technical equipment was gone, and the fear of loss of control was diminished. Institutional personnel were promised that the computer would not result in staff terminations. The Executive Vice President had become President and emphasized bringing new technology, people, and ideas to the campus. The purchase of a computer was discussed with all the offices affected. The administration considered various hardware and software proposals before making a selection.

The installation of an IBM System/34 was begun one year ago. It services fund-raising, student recruitment, financial aid, business operations, and student records. A package of software was purchased with systems in all these areas. To oversee the computer installation and the development of an institutional management information system, a new administrative position was created. The person is the liaison between the software vendor and the University administrators. The software vendor has installed one function at a time, training each user staff during a monthly visit to campus.

The addition of the new data processing function brought minor changes in institutional structure. The former Word Processing Office had reported to the Director of Development. The new Information Processing Center was moved under the new administrative position, Director of Planning and Information Systems. The former office manager of Word Processing became Coordinator of the Center, and one new staff person was added to perform data entry. The offices of University Relations and Admissions presently use the computer in a centralized mode. They send forms to the Center, their data is processed by Center staff, and they receive rosters, labels, form letters, and reports as requested. There is a considerably more decentralized environment in Financial Aid, Business, and Registrar where location of terminals and a printer give them relative autonomy.

The Information Processing Center houses word processing and data processing equipment. There are two Office System/6 word processors, one of which communicates with the computer, and an IBM Displaywriter. These three pieces of word processing equipment plus an IBM Mag Card II typewriter produce magnetic cards which are fed into two document printers. The central processing unit of the computer, the system printer, and two terminals are located in the Center. Two dictaphone units are hooked to telephones to receive dictation.

An electronic typesetter has recently been added to eliminate most of the University's need for external printing services.

The Center is staffed with a Coordinator, a Computer Operator, a Word Processing Manager, two Word Processing Operators, and a part-time proofreader. On a monthly basis, the Center produces from 3,000-6,000 form letters and approximately 1,000 original letters. Several small files are still maintained on the word processing equipment. In addition to performing central system operations for the computer, Center staff maintain donor files of 10,000 records and Admissions files of 15,000 records.

Part III - Sociotechnical System Analysis of John Brown University

The relevant probelm outputs prior to purchase of word and date processing equipment were:

1. Redundant data operations among offices.
2. Data desired by top administrators unavailable when needed.
3. Insufficient capability to cultivate prospective students and donors by mail and maintain records.
4. Minimal budget control at department level.

These conditions resulted from the interactions of various inputs and behaviors. A strong work ethic, a sense of institutional tradition and a sense of autonomy and security among administrators were the dominant human inputs. These depended on organizational inputs including policies of hiring University graduates, of transferring and promoting from within the institution, and of depending on the chief executive to be the primary spokesman and fund-raiser for the University. The organizational structure consisted of four or five relatively autonomous division heads, each of whom dealt directly with the President on matters pertaining to that division.

The technological inputs varied among offices. The student recruitment process was accomplished by a very limited Admissions staff and depended on general public relations and direct mail. The fund-raising effort was focused on support of the President, who sought large donors and endowment investments. Business operations and student records demanded high control and accuracy. The social inputs that developed included high cohesion within departments. Within most offices there was a norm of competence and getting the job done.

Behaviors resulting from these inputs and in turn affecting them through feedback evidenced the strong departmental orientation. Cross-department meetings were very rare. Most staffs took coffee breaks within the department. Top administrators took breaks together, which maintained their social ties to each other without threatening divisional autonomy. At the staff level, loyalty to the department was generally strong coupled with some distrust between certain departments. Across the institution there was some suspicion of "outsiders" and of forces that would change traditional patterns.

A number of external and internal changes brought new inputs in the late 1970s and into the present. The external factors included inflation, recessions, declining college-age population, and federal requirements for information. These brought about an increased interest in marketing as well as fiscal management among colleges. In addition, information processing technology was advancing rapidly coupled with a societal value on progress. Internally, a central administrative building was completed. The new President was less involved in fund-raising and preferred a participative leadership style. The technical aspects of the changes in information processing are described in the prior section. The human side could be predicted from a knowledge of the inputs and behaviors in the organizational system and a knowledge of the factors involved in introducing new equipment and techniques. There is a threat to workers' safety needs if jobs may be eliminated, a threat to their social needs if reorganization is involved, and a threat to the ego if there is a fear of the unfamiliar, loss of prior level of control or loss of prestige through alteration of the job description.[3]

Implementation of new word and data processing systems over the last five years has been accomplished at John Brown University as a result of and in spite of intentional and unintentional inputs. The remainder of this paper will focus on events and techniques that were functional for the transition from a manual system to one that is more machine-based as well as more centralized. The safety threat was eliminated by administration guarantees that personnel would not be eliminated. Natural staff turnover and job restructuring or transfer have been sufficient to offset conversion to machines. Reorganization or relocating of personnel has been minimal.

All three aspect of ego-need threat have been significant. The fear of the unfamiliar has been countered with information, participation, and education. There was broad administrative involvement in the selection of computer hardware and software. During the initial installation of the computer, a Computer Users' Group was formed. Membership included cabinet level officers as well as data entry personnel from the five areas directly related to the computer system. This provided an educational setting as well as a forum for both operational and philosophical concerns. Once initial education and decision-making was complete, the original group became three. The cabinet deals with computer and information system concerns as need arises. The Computer Operators' Group provides for on-going education as well as sharing common concerns. A special mid-management team is dealing with system evaluation and the final stages of system design. In addition to this on-campus education, a number of staff have taken various IBM courses at a nearby Guided Learning Center.

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[3] Donald H. Sanders, Computers in Business, McGraw-Hill Inc., 1968, p. 481.

Level of control issues varied among offices involved. One threat to control was the creation of the position of Director of Planning and Information Systems with responsibility for overseeing conversion to computer in six office areas concurrent with developing an institutional information system. Development of common data definitions, procedures that would eliminate duplication, and design of data files to serve institutional research needs run counter to individual office control. Especially in offices that pride themselves on accuracy, there is a resistance to trusting another office or a machine to deal with data. The operators' and mid-management groups already mentioned are involved with as much decision-making as possible to diminish this threat. In the Business Office, where there was concern regarding security of checks, an auxiliary printer has been purchased. This gives the office staff a much greater sense of control over their part of the computer system. When software installation began, programmer visits often left institutional staff and programmers frustrated. Staff complained of insufficient information and training after the programmers had completed a visit. Forms were developed for both users and programmers to evaluate progress and set forth clear expectations before and after each visit. In addition, staffs were encouraged to set objectives for computer conversion to decrease their sense of buying a "canned" program. The programmers have been very helpful in adapting to institutional preferences.

The threat to prestige is tied to the individual's identity. If significant competencies in that job identity are suddenly to be performed more quickly by a machine, what is the person's value? Staff to be affected by the computer were interviewed several times before and during computer installation in order to understand their perception of their job. These interviews also helped to document the preexisting manual system and develop objectives for the conversion to computer. The IBM courses allowed individuals to acquire new skills which in turn expanded their job identity and prestige. The time period of installation helped people make adjustments. The entire process will have taken one and one half years when complete. There has been time between programmer visits to test the system and develop questions for the next visit. Part of alleviating the threat of these changes is helping people understand their reactions and interactions.

As part of a professional development emphasis, most of the people involved in the computer project have recently taken the Keirsey Temperament Sorter.[4] This personality test and subsequent group discussions have helped individuals understand and anticipate their feelings toward change in general. It has also helped them to appreciate personality differences and reasons for different behaviors of people in the same situation. This understanding increases interoffice trust levels and strengthens individual identity.

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[4] David Keirsey and Marilyn Bates, Please Understand Me, Prometheus Nemesis Books, 1978, pp. 5-10.

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MIS AT A SMALL COLLEGE:
BETTER LATE THAN NEVER

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This paper presents the experience of one small college during the development of a management information system. The MIS project's goals are presented and the project is followed from conception to fruition, highlighting both failures and successes. The paper concludes with attention focused on what this college and other colleges can learn from these experiences.

Larry Long, author of the "Turnaround Time" column in ComputerWorld wrote recently, "For the record, most computer-based systems are hard pressed to earn the title of MIS..." With that happy thought, this paper presents the efforts of a small college as it endeavors to develop a computer-based management information system. The paper is divided into three basic parts: first, the history of the project through the present is described; second, the political implications and impact of administration attitudes is considered; finally the future of the project is presented along with a discussion of its successes and failures. The purpose of this presentation is to provide those involved in similar projects with ideas and caveats which may be helpful in saving both dollars and nerves.

THE SETTING

Husson College is a small business college located in Bangor, Maine. It employs roughly 300 people including food service and maintenance personnel. The College offers one, two, four year and graduate degrees to approximately 1500 students. These students consist of about 700 day, 700 evening and extension, and 100 graduate students.

The College suffers from the same financial pains as many small colleges. It has a limited endowment and relies heavily on tuition dollars for its operating budget. The project to develop a computer-based management information system was and is funded federally under the Title III, Developing Institutions program. The effect of this economic position is that the College can not afford to throw money at a problem to solve it.

THE HUSSON COLLEGE MIS EXPERIENCE

Husson's entry into the world of high technology came in the late 1960's with the use of IBM 402 keypunch machines. Certain student records and some business office functions were handled in this somewhat cumbersome way. In addition, these machines were used in an instructional program to teach keypunching.

In the mid-1970's, the College decided to computerize, primarily for academic reasons. A decision had been made to offer a data processing program. After some consideration, a DEC PDP 11/40 was acquired.

It should be noted here that the location of the College had a strong bearing on the hardware decision. At that time in Bangor, only two vendors, Digital and IBM, were equipped to perform the necessary maintenance and support functions required. While the situation has improved somewhat over the past few years, Bangor remains far removed from the mainstream and this removal places sever constraints on the College's options in many areas.

Once the Digital computer had been installed, the administration discovered that perhaps certain operational functions could be computerized. The real problems probably began here. Applications began being developed piecemeal and with no real advanced planning. A "today a payroll function, tomorrow a student grading application" approach resulted in a computerized mess. While each individual application functioned reasonably well, there was no master plan and no way of tying the various applications into an integrated system.

Much to the credit of the College administration, they did soon recognize that there was tremendous potential not being used to best advantage. While it was good to have the computer print paychecks, it was unfortunate not to be able to produce reports combining payroll and enrollment data to study cost per student. The response to this problem was to apply for federal funding to undertake an MIS project.

Once the funding was received, the College first hired a team of consultants to examine the problem. While this was a sound approach, the College was unwilling to accept what the team had to say. Once the consultants' preliminary report was complete, the College filed it and forgot it.

Next, the College appointed one of the faculty to undertake an MIS study part-time. Once again, the result was disappointing. The individual performing the study had insufficient time to devote to it and therefore could not adequately sell his findings and ideas. However, he did provide a glimpse of what an MIS that was computer-based could mean to the College and those managing it.

Finally, the College, recognizing the need and having the funding available, hired a full time director for the Management Information System project. The mandate for this person was to develop a computer-based Management Information System.

The first task undertaken by the new director was to perform a systems analysis and an information needs analysis for the College. These came five years after the computer was installed and after a great deal of application software had been developed. The findings, after several months of observation and interview, were that no one was entirely satisfied with the information they were receiving, some were entirely dissatisfied, and the top management of the institution was receiving virtually nothing of real value from the computer center.

It was clear from this analysis that some significant and perhaps painful changes had to be made. The College was not willing to finance an investment in costly commercial software, preferring instead to finance a small staff over a long period to develop the needed software in-house. (The administration was not consciously aware of this choice, but made it clear through a number of budgetary decisions.) Unfortunately, development of the software was hindered by virtue of the organizational structure. While the Director for MIS reported to the President, and functioned on the level of a Dean, the Director for Data Processing, Computer Center staff and programmers all reported to the Vice President for Financial Affairs. The result was that no new development under the direction of the MIS director ever took place.

A proposal was submitted that the Director for Data Processing and all Computer Center staff report to the MIS Director. Gradually, (things do move slowly in academia) this proposal was accepted and the organizational shift took place. This change allowed developmental work to begin and made implementation of a computer-based MIS possible.

People cling to that with which they are familiar. The programmer chiefly responsible for developing the various existing applications operating at that time could see virtually no reason to change anything. The result was a virtual impasse. The administration would not take action nor allow action to be taken against the programmer, who had been employed by the College in various capacities for nearly fifteen years. The project ground to a halt.

The goal, as seen by the MIS Director, was to develop a computer-based system, which through a dictionary or some type of data base system would allow the various applications to be related. Further, the system would provide reports at all levels of detail to all levels of management thereby facilitating the decision-making process. Finally, the system would provide a generalized report-writing function, user-friendly enough that with relatively minimal training, virtually anyone in the institution could produce their own one-time special purpose reports. The plans to achieve this had been developed but work was not progressing.

Luck does play an important role in all major projects. On the surface, it may not seem lucky that during this impasse, a pipe running over the Computer Center burst and sent hot water streaming through the 11/40 CPU, destroying it totally. This apparent disaster was very fortuitous in that it caused a change in some of the administrative constraints and restrictions, and allowed for some creative problem solving approaches.

The decision was made to convert to an IBM System 34 and to purchase software developed at St. Anselm's College in New Hampshire. The System 34 provided a core system on which to build the MIS. This software used an indexed file structure which provided, at least minimally, a kind of data base structure.

The conversion took place in August, 1981. Since that time, all the major administrative applications have been implemented, except accounts payable which is now under development. Major modification is still required and an increasingly large time committment is required for maintenance.

The new systems do provide reports at various levels of detail and can easily relate with each other. Individuals throughout the College are learning to use IBM's Data File Utility to produce their own reports. It has not been and still will not be as easy to complete the implementation of the MIS as these last few sentences have made it sound.

THE POLITICS OF MIS

Information is power. There was a very proprietary attitude toward information at Husson College. The Business office believed it owned the budgetary data, the registrar's office believed it owned the student record data. The impact of this attitude was to make each area of the College resistant toward the concept of an MIS as it applied to that area, but very positively disposed in general.

This attitude or set of attitudes was first recognized and described by the original consultants hired by the College. They stated that an MIS could not be effectively implemented until all areas of the College cooperated and recognized that information was not owned but instead should be shared. The problem facing the MIS Director was how to overcome this set of attitudes.

The first step was the change in reporting alignments. By making the Computer Center an independent entity in the College structure, it was recognized more as a nodal point for data and information gathering, storage and reporting. In one sense, the change served to de-politicize the Computer Center. It became a true service organization to the College, rather than a branch of the business office.

The next stage was the beginning of an ongoing re-education process among the administration. The task before the MIS Director was to sell the value of the MIS to the College. By showing all the administrators how they could benefit from the MIS, they would gradually come to support the project in toto. This process of education continues and to date has consisted of both seminars and individual meetings.

The effect of a functional management information system will be to leverage work down to the organizational level where it can best be performed. The detail work, in particular, drops to more clerical levels while the top executives are left with truly informational, summary reports. This shift in work can, and in the case of Husson College has, produced some difficulties.

The problems resulting from this shift are not always those one might expect. The most significant difficulty, and the one most threatening to the MIS project, is the case of the executive who becomes uncomfortable when stripped of the detail work. This individual is typically at a level in organization which could stop the implementation of an MIS at any time.

The easiest solution is to continue to provide the accustomed detail to all levels and then gradually, through a re-education process, wean the detail away. While this will reduce the overall effectiveness of the project for a time, it will provide for its long term success.

Overall, the best breakdown of the political stages involved in the development of an MIS comes from Hannah McCarthy, President of Daniel Webster College.

1) Exaltation -- As the potential value of the MIS is recognized;
2) Disenchantment -- As the complexity and cost of the project is realized;
3) Confusion -- As the project begins and nothing seems to go as expected;
4) Search for the guilty -- As the administration is forced to react to what seems to have been a terrible mistake.
5) Punishment of the innocent -- As the guilty are hard to find, only those who still think the MIS project is a good one are left;
6) Praise for the uninvolved -- As the project is successfully completed,

those at the top receive the praise for the foresight and courage to undertake such a gargantuan task.

THE FUTURE OF THE HUSSON MIS

The MIS Project at Husson still has a long way to go. In fact, its ultimate success is not insured. The groundwork has been laid and the major components are in place.

What has gone right and wrong? What should have been done differently? What can others learn?

The initial reaction of the College to turn to outside consultants was an excellent one. The mistake made was the unwillingness to listen to those consultants.

MORAL: If you do not have the internal expertise, use consultants. Once the decision has been made, really use them. Don't hire them if you don't trust them. Be prepared to follow through on their advice.

The decision to buy a computer was good, although premature. The College should have determined its needs before concerning itself with hardware.

MORAL: Software must precede hardware. The system analysis should come first, then a determination of what kind of software will meet the needs identified in the system analysis, and finally the hardware can be considered.

Even with federal funding, the College was not really prepared for the expense involved in a project of this type. Once started, it was too late to stop. This placed very restrictive financial conditions on the project, forcing some expensive shortcuts.

MORAL: If you are not sure you can afford at least twice your original expectation of cost, don't start at all.

Unless you have remarkable internal expertise or a lot of money to acquire that expertise, major software development should not be done in-house. The College's decision not to finance software purchases was a mistake.

MORAL: Buy your major software components. Reinventing the wheel is expensive, and too often it comes up flat.

Finally, the major aspect of MIS implementation is re-education. The MIS must be sold and re-sold throughout the College. The College did recognize this; however, in some quarters, the MIS was sold as a cure-all. An MIS facilitates communication--it does not create it. An MIS will greatly aid a strong administrative team, but it will hurt a weak one.

MORAL: An MIS is not a cure-all. It should be sold throughout the organization as an administrative aid, not as a new super administrator.

Husson College has learned a great deal about computers, about management information systems and about itself during the course of this MIS project. Ultimately, this project will succeed at Husson because the College was willing to have the groundwork laid and because its importance is recognized. Many mistakes have been made, and undoubtedly more will be made. Hopefully, other small colleges can learn from these mistakes and avoid them. Remember, however, when considering your own projects, it is true that "Murphy was an optimist."

TRACK V
GREAT APPLICATIONS

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User Controlled Data Management
A Decade of Progress in the State University System of Florida

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The State University System of Florida (SUS) is an expanding, complex system of nine universities. It enrolls over 130,000 students, has an annual budget of approximately $1 billion and is governed by a Board of Regents (BOR). Over the past decade the System has developed a sophisticated data management process designed to supply the information needed at the Board and university levels for successful governance. This process is unique in that it has been built and is controlled principally by the users of its information.

This paper details the development of this data management system with special emphasis on its user controlled aspects. The paper begins with a historical account of the development of the major components of data management including system documentation, computer data files, regional data centers, computing networks and uniform transaction systems. A description is given of current developments including the data management policy, the data base coordinating committee and the institutional data administrators.

A major portion of the paper concerns the ways in which data are used in the decision making process in budgeting, fiscal management, academic program evaluation and control, collective bargaining, personnel management, facilities management and student affairs.

HISTORICAL PERSPECTIVE

In 1969, Florida underwent a governmental reorganization which resulted in a mandate for a single legislative request budget for the State University System. This request budget had to project seven years' personnel and funding requirements by department, for the present level, for an increased quality level and for a decreased quality level.

The plan to accomplish this single request budget was pretty straightforward. The universities were to complete their individual budgets and submit them to the Regents Office for combining.

The first part of the plan worked great! The universities completed their budgets and submitted them to the Regents Office. It quickly became apparent that the physical amount of paper made the process totally unmanageable since the university budgets were hard copy and the Regents Office had no computer software or hardware.

Needless to say, this first effort to produce a system request budget was not successful except that it reinforced the shortsightedness of this approach.

In 1970, a decision was made to collect disaggregated data on a snapshot basis to support the budget process. A subcommittee of university budget officers was appointed to develop specifications for six separate computer data files to be submitted to the Regents Office. The specifications developed for each file consisted of a file format, the data element names and the physical description of the data element.

The six required data tapes were: 1) an Admissions File, 2) an Authorized Position File, 3) an Academic Assignment File, 4) a Student Data Course File, 5) an Instructional Activity File, and 6) a Physical Facilities Space File.

In the Summer of 1971, the Regents Office became an RJE station to the computer center at the University of Florida. The first computer hardware included two 2741 terminals, a keypunch machine, a card reader and printer. Staffing for this venture was two half-time student programmers.

That Fall, the first data tapes were received. However, they were not useable. This experience highlighted the need for documentation, common definitions, edit criteria, and a flexible retrieval capability. In spite of these problems, it was still felt that the decision to collect disaggregated data to support the budget process had been a good decision, but more planning was required to insure that the data was good and comparable when received.

In 1972, some positive things begin to happen. First, the MARK IV File Management System was purchased which provided the much needed flexible retrieval capability.

Second, a formal effort began which developed standard systems to support the operating levels within each institution. A by-product of these systems would be the data tapes. The concept, then and now, was that the best data for statewide information is that collected and used in the day-to-day operation of the university.

In the Spring of 1973, the responsibility for the data tapes was moved from the Budget Office to the Management Information Office within the Regents Office. This change was made for several reasons. The Regents Office was reorganized. Detailed documentation of the data tapes was required. This documentation had to include standard definitions, edit criteria and usage of the data. Computer software was needed to edit the data. Coordination was mandatory between the standards systems development and the development of the data tapes, and non-budget uses for the data were developing elsewhere within the Regents Office.

In January 1975, a Data Management and Data Administration plan was prepared. It was at this point that top management became involved for the first time. A BOR Data Committee was established. The committee was comprised of a director or associate director level representative from each of the functional areas of the Regents Office: Academic, Budget, Personnel, and Finance. The SUS Data Administrator chaired this committee. The committee responsibilities included: 1) develop the management information policy for the Regents, 2) define management data needs, 3) define each data element and develop the edit criteria for that element, and 4) specify the submission dates for each of the files.

At the same time the BOR Data Committee was established, the Chancellor asked each University President to appoint an Institutional Data Administrator. The Institutional Data Administrator had the following responsibilities: 1) participate in the formulation and execution of the management information policy for the University and the University System, 2) review SUS data requirements, 3) coordinate the data collection for the data tapes, 4) serve as the university contact for all information request received by the SUS Data Administrator which cannot be filled by the BOR data bases, and 5) serve as the institutional representative on the Committee of Institutional Data Administrators.

With these two groups in place, the data management process became more structured. All requests for new data to be added to the data tapes or changes to the existing data are presented to the BOR Data Committee. The requestor must furnish a definition and a detailed explanation of why this addition or change in the data is required. If the committee agrees there is a need supported by law, rule or policy, for the request, it is then sent to the Institutional Data Administrators as a proposed item for review and comment.

The Institutional Data Administrators review the request with the appropriate people on campus to determine the impact of this proposal. Comments from each University are sent to the SUS Data Administrator and the BOR Data Committee for consideration prior to final action being taken on the proposal.

As the more formal process developed, it became apparent that a critical ingredient was still missing. For data management to be effective, controls were needed to keep to a minimum non-essential data demands. The structure of the process now focused on data demands. They were no longer viewed as occasional information requests, they were seen as consumers of tremendous resources. At last top management was as concerned as the front line firefighters about the growing demands for information, particularly as the planning process external to the SUS became more sophisticated.

Enter the missing ingredient--A set of policies for data management endorsed and enforced by top management. These policies have proven to be the mainstay of the data management process since the flow of data and information is monitored in a formal manner and is administered to provide support to the decision making process at both the university and university system level.

APPLICATIONS

Numerous applications are possible using the information available through the data management process. This paper will review several specific applications to demonstrate the flexibility of the data and its relation to operating systems and the decision process.

Two concepts adopted in the initial stages of the data management process should be kept in mind as each specific application is discussed: 1) the best data for statewide information is that collected and used in the day-to-day operation of the university, 2) standard software systems to support the daily operating needs of the university.

A major application in the data management process is the building of the operating and legislative request budgets. The State University System is required to present an annual operating budget to the Governor and both Houses of Legislature. This system budget which is approximately $1 billion and consists of 13 entities, 197 funds, over 8,250 accounts is built by computer software from computerized files submitted by each university. The operating budget represents each university's plan for using the financial resources available through direct appropriation by the Legislature, by the university system allocation or from local sources. All the provisions of the Legislative Appropriation and the System Allocation must be implemented and traceable in the budget plan.

The data collected for the operating budget are used for four general purposes: 1) preparation and management of the operating budget, 2) preparation of the request budget, 3) analysis of expenditures, and 4) monitoring of expenditures.

The process for preparing the operating budget begins with the creation of a Skeletal Authorized Position File. This file is a bare bones version of the Authorized Position File, one of the base files for data management. It contains the basic budgetary information on each line item position, as well as some information about the individual occupying the position. Computer software uses the Skeletal Authorized Position File to create a schedule which details all salary requirements. Since salaries represent about 80% of the budget, this schedule is a critical one and it is used by university personnel in budget management activities all year long. This schedule provides the salary calculations for the operating budget.

Budgeted amounts for temporary labor, expenses and capital equipment are entered from a working file or extracted directly from the CORE Financial System, the standard system which handles the university's daily accounting.

Historical information for the past operating year is also displayed in the operating budget. This information is extracted from the prior year's CORE Financial System and Authorized Position File. Historical and operating year data are displayed by function, program component, discipline group and discipline category. Finally, there are schedules to indicate sources and amounts of revenue needed to fund the amounts budgeted.

The published operating budget contains the following exhibits and schedules:

Exhibit B - Expenditures by Category and Fund
Exhibit C - Summary of Estimated Expenditures by Account/Department
Exhibit D - Summary of Estimated Expenditures at Department by Function and Program Component
Exhibit E - Summary of Expenditures by Budget Entity and Expenditure Category
Schedule 1 - Budgetary Cash Flow Summary
Schedule 1A - Summary of Incidental Trust Fund Revenue
Schedule III - Detail of Salaries

An expansion of this application is the production of the legislative request budget. This budget is the State University System's request to the Legislature for funding for the next biennium. It consists of actual expenditures for the history year, and estimated expenditures for the current year and requested funding for the upcoming two years. This information is presented in expenditure detail and narrative in three parts: To continue current programs, To improve current programs, and To add new programs.

As noted earlier, the data collection which supports the operating budget provides much of the information needed to produce the legislative request budget. Through computer software the data extracted from the CORE Financial System and the Skeletal Authorized Position File for the operating budget is projected using certain preset parameters to build the Legislative Request Budget. Special programmatic issues are added through manual input options.

Since most education funding is still tied to enrollment, a key file supporting the request budget is the Student Data Course File. This file is used in establishing levels of budgeted enrollments. However, enrollment limitations are taking the pressure off projecting enrollments in the budget, and shifting this pressure to enrollment master planning. This process will be discussed later.

As can be seen, the budget catastrophy of 1969 which gave birth to the data management process has become a relatively routine task--generating budgets from operating systems.

Another application tied to operating systems is the presentation of an annual consolidated financial statement for the State University System. This statement is produced through the data management process. The information required for the system statement is extracted from the CORE Financial System at the university level at the same time that the individual university statement is produced. Through computer software, individual university statements are combined to produce the System statement. With this combined data, further analysis is made to produce a financial report which is easily understood by the non-financial reader.

Another application receiving considerable attention is the data collection activity which supports energy conservation. Since the State University System is a state agency, it is involved in substantial energy reporting efforts.

Data on various fuel costs and usages are gathered on a monthly basis. Originally, several different reports were involved along with several departments. Through the leadership of the BOR Data Committee, these departments, working together, developed one reporting format capable of collecting data for multiple uses.

This application is a great example where good data pays off. As a result of this improved data management effort, it was learned that the SUS had made significant strides in energy conservation and were awarded a plaque in recognition of outstanding conservation efforts by a major southeastern power company. In addition to reporting related to energy conservation, this application is used in developing funding requests for utilities and deferred maintenance.

In education about 80% of the operating dollars are committed to personnel. A number of applications exist for personnel and affirmative action reporting. In Florida, the faculty and many units of the other staff are covered by collective bargaining contracts. Salary policy and contract decisions are critical as management negotiates with the unions. Key to supporting this effort is the Authorized Position File. Since this file carries information about both the position and the person who occupies the position, computer analysis is possible to evaluate alternative salary and benefit proposals. Remember that the Authorized Position File was a key in the budget process. The inter-relationship of data required by the data management process demonstrates a recognition by management that these relationships are important and are used in decision making.

Another major user of the data management process is Academic Programs. The responsibilities of the Academic Programs Office are: academic degree program control, academic program review and evaluation, and academic program planning. The data management process is vital to their successful accomplishment.

Academic Degree Program Control. During the mid 1970's, the Regents became concerned with the continuing proliferation of new degree programs. In many cases, each of the universities seemed to be trying to offer every program for which there could conceivably be a need. State funding was not based on the number of programs offered. The continued establishment of new programs without a corresponding reduction in existing programs had the effect of diluting the funding available for each program; a situation not very conducive to producing quality higher education.

In response to this situation the Academic Programs Office established a series of procedures designed to bring academic degree program proliferation under control and institute systemwide program planning. As a part of these procedures, a standard set of data concerning the degree programs was created. This systemwide program data would facilitate academic planning at both state level and the university level.

The first step was the construction of an inventory of authorized degree programs within the System. The Higher Education General Information Survey (HEGIS) taxonomy was adopted as the framework of the inventory. The initial inventory was compiled from past HEGIS Reports from the individual universities, from university catalogs, and from Regents Minutes showing degree programs approved. Working with university academic administrators, this initial draft was modified until a coherent inventory, which generally satisfied all universities, was finished and approved by the Regents as the authorized inventory of degree programs. Any changes to this inventory, starting new programs or cancelling existing ones, must be approved by the Regents. This inventory is used as a major edit device of the reports and computer files submitted by each university. An institution is not allowed to have students or degrees in programs other than those authorized for that institution.

The second step in our efforts to control academic programs was to specify a procedure by which a university could submit a request for a new program including required information on the need for the program, the resources available and/or needed, and the costs involved. University supplied information is supplemented by the Regents staff with data on similar programs within the System, the numbers and levels of students enrolled, student demographic information, and the number of degrees granted; all obtained from the data base. Specifically, this data is obtained from the Enrollment Report and File Edit Reports produced by the data management process. The Regents make a determination whether to approve a new program based on this information.

There have been several positive results of these efforts to control academic degree programs. Degree proliferation has been significantly slowed. These procedures provide a mechanism which allows local university administrators, as well as the Regents, to resist pressures to proliferate degree offerings. They require university faculty and administrators to consider the State's real need for a proposed new program as well as the institutional resources available to offer it. This process demonstrates to the public and to the Legislature responsible planning and utilization of public resources by the System.

Academic Degree Program Review and Evaluation. In 1975, the Regents adopted a policy requiring periodic review of all authorized degree programs to confirm that they meet standards of quality, efficient management and optimum service to their intended clients and the needs of Florida. This policy was established in order to provide periodic outside feedback to the universities as to the quality of their academic programs, to identify program deficiencies and potential solutions, and to facilitate academic and budgetary planning at the local and state levels. Throughout the process the emphasis is on cooperative endeavor between the universities and the Regents Office. All programs in a given discipline are reviewed at the same time. The methodology adopted for the review and evaluation of degree programs includes the use of outside discipline consultants making on-site visits to the programs under review. These consultant review teams are provided a base of common data obtained from the data base covering all the discipline programs under review. On the basis of the data and that gathered during the on-site visits, the consultants prepare a report to the Regents including recommendations for action. It is our intention that programs in each discipline be reviewed once every five years.

Data management products are vital to program review as they provide the basic data. Both the computer files and standard reports are utilized. Student and grading information is obtained from the Student Data Course File, course size and other course related information from the Instructional Activity File, and faculty information from the Authorized Position File. Pertinent data is also provided from the Enrollment Reports, the Fact Book and HEGIS Reports which are all a part of the data management process.

The academic program review and evaluation has resulted in the identification of several unneeded, underproductive or low quality programs. In most cases, resources have either been targeted on these programs to correct their deficiencies or the programs have been eliminated. Likewise, programs of excellence have also been identified. The overall result has been an increased concern within the SUS with improving the quality of our programs. The results of these formal reviews provide justification for Legislative request budget, special program allocations, and Regents program decisions.

State University System Master Planning. The Florida Legislature has recently directed each branch of the public education system--public schools, vocational/technical schools, community colleges and universities--to develop a ten year master plan and to update the plan every two years. The University System Master Plan will include a re-evaluation of System goals and institutional role and scope. It will include an enrollment plan and a budget plan, both of which will be updated annually.

The methodology used to produce this Master Plan includes the appointment of interinstitutional committees to produce its various sections; the carrying out of special studies concerned with state populations and university resource and need projections; the conducting of public hearings to test ideas and gain public input, and the writing of a final plan for approval by the Regents.

Data supplied through the data management process is absolutely essential to building a master plan. Specifically, admissions data is obtained from the Admissions File, student demographic information from the Student Data Course File, course enrollment data from the Instructional Activities File, faculty and staff data from the Authorized Position File and space information from the Facilities File. In addition, standard reports are utilized including the Enrollment Reports, the Tape Edit Reports, HEGIS Reports and Fact Books.

STRATEGIC PLANNING: A NEW ROLE FOR MANAGEMENT INFORMATION SYSTEMS

by

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ABSTRACT

Management information systems in the past have tended to focus on data elements relating to internal operations of the institution such as registration, scheduling, class rosters, space utilization, grade reporting, student aid, payroll, budgeting, and otner administrative applications. Strategic decision making as a part of the higher education planning process, however, is becoming increasingly more dependent upon data elements external to the institution.

Strategic planning is, essentially, a way to match an organization's resources to a changing environment. It requires a capability to moniter changes in society, assess the strengths of the institution, and a way to match the two. Tools to evaluate the needs of society include (1) needs assessment, (2) trend analysis, (3) environmental scanning, and (4) market analysis. These tools can be used in institutions at various stages of maturation (emergence, growth, development, regeneration, decline) and a variety of modes of operation (hierarchial, collegial, collective bargaining).

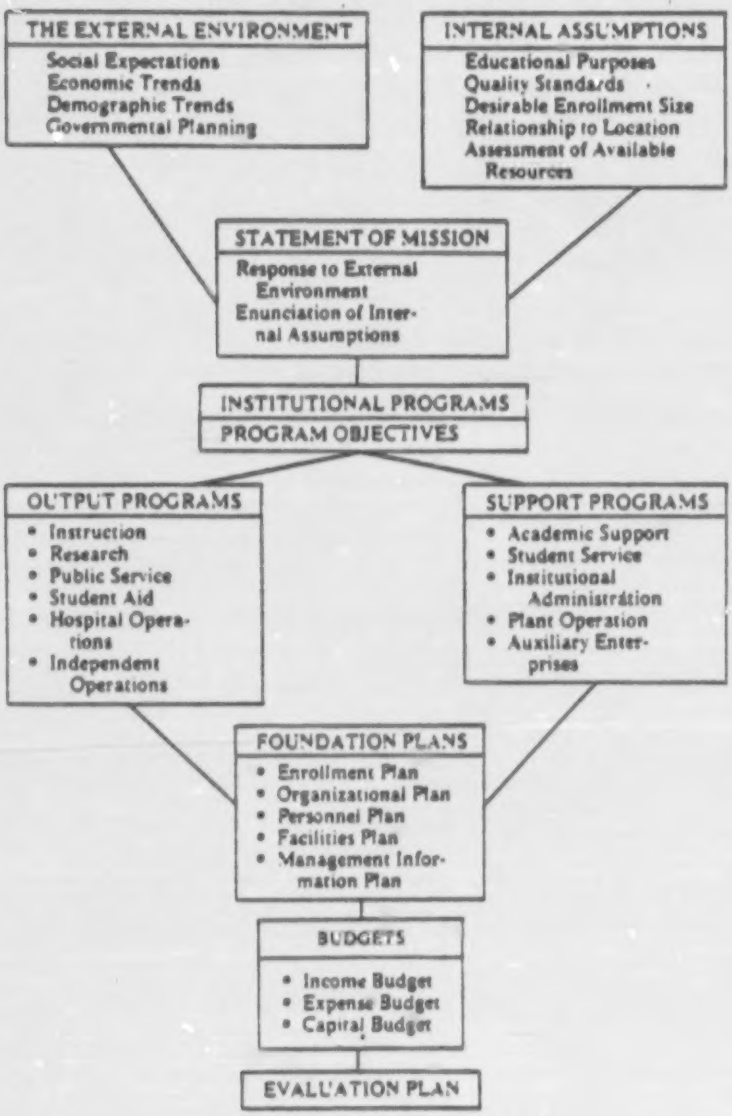
Strategic Planning

At the 1974 CAUSE Conference, John D. Millett, former Executive Vice President of the Academy for Educational Development and Chancellor Emeritus of the Ohio Board of Regents, stated that the largest single challenge facing higher education was that of planning. He stated:

> Planning for the future is the largest challenge facing higher education today. It is a challenge that can only be met with the courage to innovate, the will to influence events rather than to surrender to them. But the courage to innovate and the will to change have some hope of achievement only if information analysis and assessment have preceded action.
>
> Higher education management needs information. And then higher education management needs the capacity to know how to use information as the basis for trying to achieve a desirable tomorrow. Just as human intelligence is our product, so also is human intelligence our only hope for the future of higher education itself.[1]

During the post World War II years institutional planning had a focus on acquiring more resources and building facilities for the increased number of students resulting from the equal right demand for access to postsecondary education. Planning in postsecondary education during the 1960s was undertaken in response to immediate needs with minimum regard to the future. During the 1970s the influx of traditional 18 to 22 year old students began to stabilize. Many private and public senior institutions began to experience the impact of a broad range of demographic, social, political, and economic forces. As a result, organizations such as The Council for the Advancement of Small Colleges (now The Council of Independent Colleges), the Academy for Educational Development and the American Association of State Colleges and Universities launched programs relating to comprehensive institutional planning. The planning process model developed as a result of the AED project is displayed in FIGURE 1.[2] These projects and others like it all stressed the need to assess the external environment. The literature began to reflect descriptions of institutional planning processes including some way to assess the external environment.[3]

THE PLANNING PROCESS
IN HIGHER EDUCATION


THE EXTERNAL ENVIRONMENT
Social Expectations
Economic Trends
Demographic Trends
Governmental Planning
INTERNAL ASSUMPTIONS
Educational Purposes
Quality Standards
Desirable Enrollment Size
Relationship to Location
Assessment of Available Resources
STATEMENT OF MISSION
Response to External Environment
Enunciation of Internal Assumptions
INSTITUTIONAL PROGRAMS
PROGRAM OBJECTIVES
OUTPUT PROGRAMS
• Instruction
• Research
• Public Service
• Student Aid
• Hospital Operations
• Independent Operations
SUPPORT PROGRAMS
• Academic Support
• Student Service
• Institutional Administration
• Plant Operation
• Auxiliary Enterprises
FOUNDATION PLANS
• Enrollment Plan
• Organizational Plan
• Personnel Plan
• Facilities Plan
• Management Information Plan
BUDGETS
• Income Budget
• Expense Budget
• Capital Budget
EVALUATION PLAN

John D. Millett, Higher Education Planning: A Report of Experience and a Forecast of Strategies for Change (Washington, D.C.: Academy for Educational Development, 1978).

The literature also began to reflect articles intended to clarify the concept of strategic planning. The term "strategy" is used to refer to long-term intentions transcending annual or biannual operations planning. Ellison states:

> It is within the framework of strategy that annual budget planning and preparation take place. Alfred D. Chandler, in his business history Strategy and Structure, defined strategy as "determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals." Strategic decision-making is concerned with the long-term health of an organization rather than with day-to-day operations. Also, a strategy is not in force until an institution has made a resource commitment to support carrying out the strategy.[4]

Peters states:

> Strategic planning is a process that directs an organization's attention to the future, thereby enabling the organization to adapt more readily to change.
>
> The major contribution of the planning process to good management is the rationality it imposes on an organization's efforts to anticipate its future.
>
> Creative organizations are able to examine the basic assumptions under which they operate and to adapt them to new situations. Creativity is a basic tool for good planning and not some poetic appendage to the process.[5]

Thieme states:

> Real strategic planning does not start with assumptions about institutional mission. Mission can only be realistically set after a careful assessment of the external environment and the internal strengths and weaknesses of the institution and after identification of practical options.[6]

Ross states:

> Planning is no more than a conscious, rational process of deciding upon a desired future state and commiting resources to achieve it. When speaking about planning, it is necessary to differentiate between informal planning, which everyone does, and formal strategic planning. Even the most unsophisticated manager gathers and organizes data, makes assumptions about the specific universe, establishes goals and objectives, and sets priorities for activity. Informal planning differs from formal planning in that in the first case the manager makes the decisions

> alone. The informal plan lacks a multi-disciplinary perspective, and has no rigorous methodology.[7]

Collier indicates there are five essential elements in the strategic planning concept:

1. Strategic planning involves the explicit consideration of a set of decisions which determine the future of the entire organizational entity.
2. The total strategic planning process is comprised of the initial strategy formulation process (in which the set of strategic decisions are made) and the implementation/budgeting process (in which the initial strategy is reformulated and an emergent strategy evolves).
3. One of the primary criteria used in making strategic decisions is the achievement of a simultaneous match among (1) the organization's resources, (2) its proximate environment, and (3) certain inherent characteristics of the organization.
4. Strategic planning encourages organizations to take the initiative in creating their own future and to consider the future they are creating for themselves.
5. The set of strategic decisions should be synergistic and they should increase organizational flexibility.[8]

Thieme suggests there are seven key objectives of the strategic planning process:

1. Challenge the prevailing assumptions about the role and purpose of the institution.
2. Identify service area needs that are not adequately met.
3. Develop a plan that recognizes both external and internal realities.
4. Achieve consensus among key organization members on future strategies.
5. Favorable influence the perspective of internal and external constituent groups.
6. Link strategic planning to operational management.
7. Educate key people as to the external and internal realities as well as to the values and aspirations of key groups.[9]

Shirley and Caruthers specify five major dimensions of an organization as (1) the environmental dimension, (2) the strategic dimension, (3) the structural dimension, (4) the behavioral dimension, and (5) the program dimension.[10]

Their conceptualization is displayed in FIGURE 2.

Cope states that "Strategic planning assumes an open system in which organizations are dynamic and constantly changing as they integrate information from turbelent environments. Strategic planning focuses on the external environment, on qualitative information and intuitive decisions regarding resource commitments, and on integrated, participatory involvement."[11]

The Management Information System

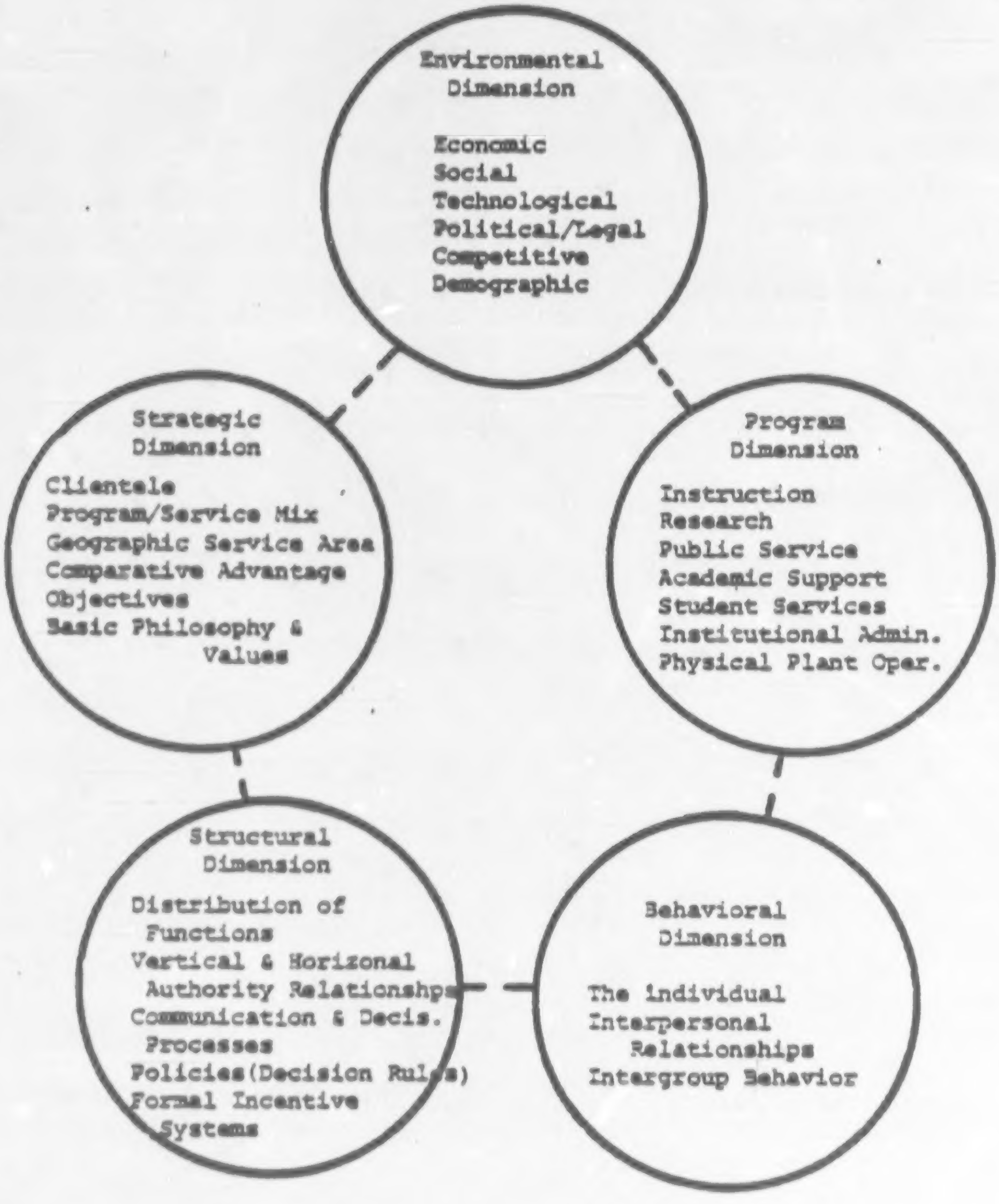
Planning, however defined, has a focus on designing and shaping the future as opposed to merely changing. Strategic planning must consider a critical analysis of forces, trends, and their effects and must be firmly based on demographics, social, political, and economic data sets. Integral to planning are methodologies for (1) generating goal statements and standards; (2) sorting, categorizing and prioritizing goals; (3) refining goals, noting interrelationships among them; and (4) specifying the relevance of goals to the support base.

Data are the foundation upon which to build the multi-year institution/system Plan, a document containing a grand design representing intelligent anticipation of activities, events, and experimental observations carefully specified in advance to move from one point to another. Data are needed (1) about environmental assumptions upon which to base planning; (2) about potential clients and unmet societal needs growing out of a needs assessment or market analysis/market segmentation process; and (3) for managing institutional areas as specified above. Probably most important, however, the data analysis process must strive to produce meaning as it relates to efficiency and effectiveness of relating dollars to institutional goals and objectives.

Planning, then, is critical analysis and requires the development of an analytical capability to collect, array, and analyze a large number of variables in an effort to portray a system of relationships, causality in some cases. The

FIGURE 2

FIVE MAJOR DIMENSIONS OF AN ORGANIZATION*


Environmental Dimension
Economic
Social
Technological
Political/Legal
Competitive
Demographic
Strategic Dimension
Clientele
Program/Service Mix
Geographic Service Area
Comparative Advantage
Objectives
Basic Philosophy & Values
Program Dimension
Instruction
Research
Public Service
Academic Support
Student Services
Institutional Admin.
Physical Plant Oper.
Structural Dimension
Distribution of Functions
Vertical & Horizonal Authority Relationshps
Communication & Decis. Processes
Policies(Decision Rules)
Formal Incentive Systems
Behavioral Dimension
The individual
Interpersonal Relationships
Intergroup Behavior

---

* Robert C. Shirley and J. Kent Caruthers, "Strategic Planning for Higher Education," presented at the annual meeting of the American Association of State Colleges and Universities, November 20, 1979.

latter is the primary function of the Management Information System.

Management information systems in the past have tended to focus on data elements relating to the internal operations of the institution such as registration, scheduling, class rosters, space utilization, grade reporting, student aid, payroll, budgeting, and other administrative applications. Data have been collected and grouped in files labeled student, personnel, financial, and space. Sometimes the data elements are similar for various reporting agencies and occasionally the independent files can be integrated to produce meaningful reports on topics such as program cost analysis and student longitudinal studies. Occasionally independent file reports or integrated file reports are synchronized with decision points in the annual planning/budgeting cycle but usually stop short of strategic planning. Management information systems of the future must include the integration of internal and external data sets as displayed in FIGURE 3.

Strategic Planning In Differing Contexts

Organizations pass through various stages of development and have different characteristics of organizational functioning. Stages of organizational development were listed as emergence, growth, development, regeneration, and decline.[12] Types of organizational functioning can be listed as hierarchial, Theory X; collegial, Theory Y; and political, collective bargaining.[13] In addition, tools of strategic planning can be labeled needs assessment, trend analysis, environmental scanning, and market analysis. These three dimensions form a model to help assist institutions to diagnose where they are in the evolutionary process. (See FIGURE 4) The challenge to postsecondary institutions is to diagnose where they are with regard to the first two dimensions and develop elements of strategic planning appropriate for their context.

FIGURE 3

THE INTEGRATED INTERNAL-EXTERNAL MANAGEMENT INFORMATION SYSTEM

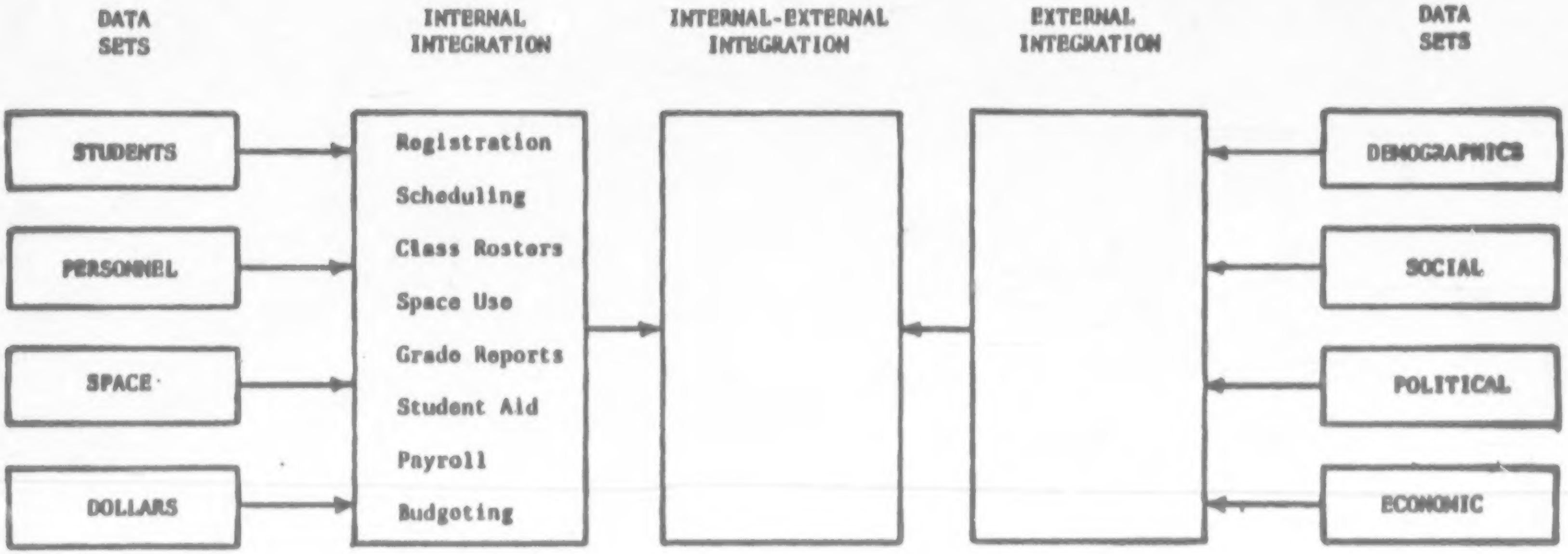
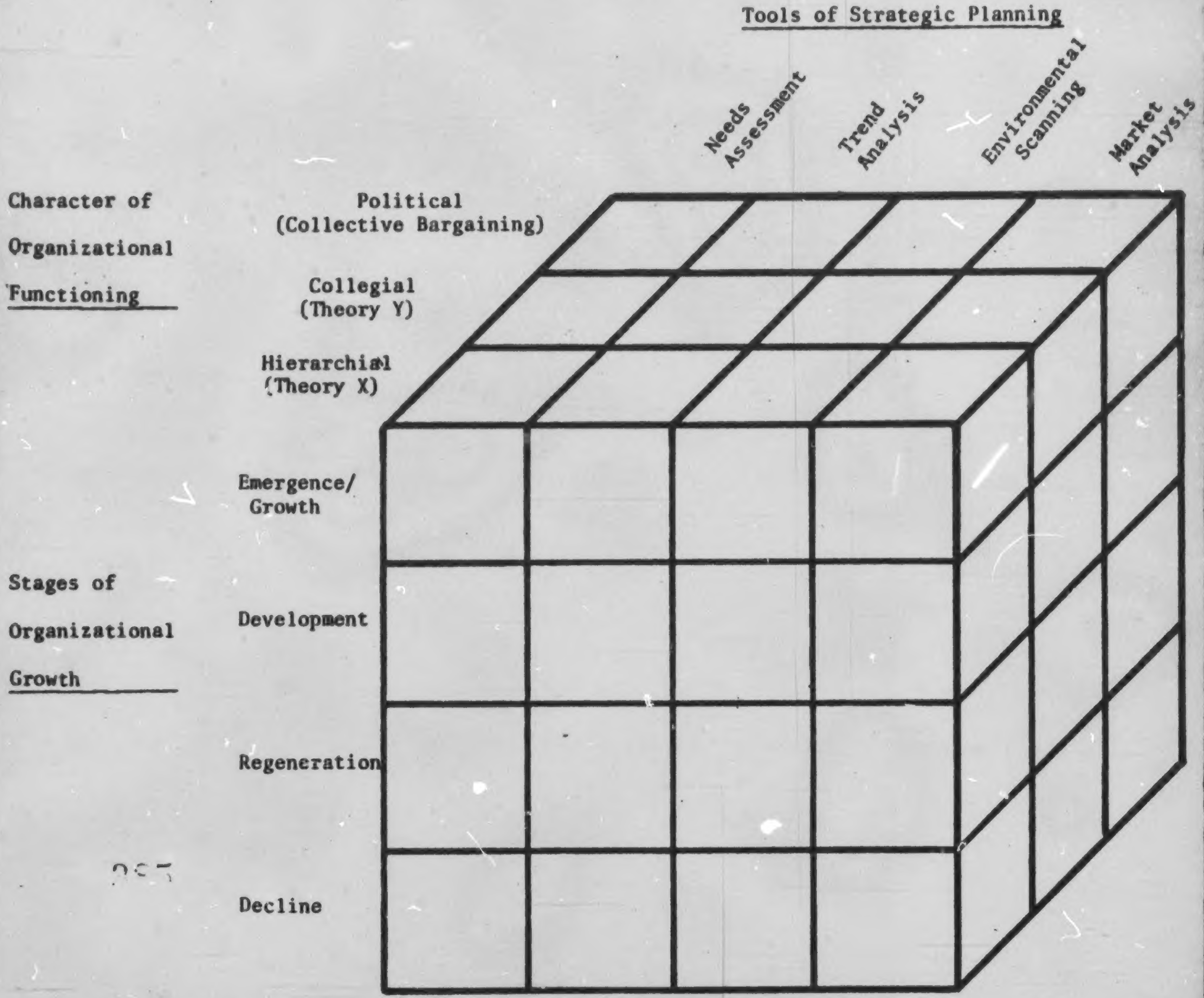

DATA SETS
INTERNAL INTEGRATION
INTERNAL-EXTERNAL INTEGRATION
EXTERNAL INTEGRATION
DATA SETS
STUDENTS
PERSONNEL
SPACE
DOLLARS
Registration
Scheduling
Class Rosters
Space Use
Grade Reports
Student Aid
Payroll
Budgeting
DEMOGRAPHICS
SOCIAL
POLITICAL
ECONOMIC

FIGURE 4

MODEL FOR CATEGORIZING DIMENSIONS OF STRATEGIC PLANNING

BY STAGE OF ORGANIZATIONAL GROWTH AND CHARACTER OF ORGANIZATIONAL FUNCTIONING


Tools of Strategic Planning
Needs Assessment
Trend Analysis
Environmental Scanning
Market Analysis
Character of Organizational Functioning
Political (Collective Bargaining)
Collegial (Theory Y)
Hierarchial (Theory X)
Stages of Organizational Growth
Emergence/ Growth
Development
Regeneration
Decline

Ahmann indicates that needs assessment is a generic term to describe a process "for determining the discrepancy between existing and desired levels of attainment with respect to specific educational goals."[14] He describes types of needs assessment and the state of the art which has shifted from informal to formal, systematic efforts beginning in the early 1970s attributable primarily to the accountability movement stimulated by federal legislation. Vlahos traces several changes in needs assessment techniques including its application to perceptions of the community and business and industry.[15]

Trend analysis consists of the systematic review of comparable data over time in order to determine direction. Harris and Grede present two examples of change in the labor force in the United States.[16] (See FIGURES 5 and 6 in Appendix A) Frances and Warmbrod present data about changing enrollments.[17] (See FIGURES 7 through 10 in Appendix A) Wattenbarger and Bibby, Conroy, and Chambers present data about financing education.[18] (See FIGURES 11 through 13 in Appendix A)

Environmental scanning consists of periodic sampling of data which may ultimately form the foundation of trends. An example of such a scan is the College Entrance Examination Board study indicating that 36 percent of the population between the ages of 16 and 65, more than 40 million Americans, are in a career transition status.[19] Research by the College Board, however, indicates that only about ⅓ of the 58,400,000 persons in postsecondary education are enrolled in colleges and universities. (See FIGURE 14 in Appendix B) Other examples of scanning include The Ohio Board of Regent's survey of business/industry training programs and the Health Planning and Development Council's survey of employee health promotion programs sponsored by business and industry. (See Appendix B)

Market analysis consists of obtaining detained information about markets or market segments served or unserved by the institution. Market analysis is an organized effort to identify the relationship between specific wants and needs of people and the ways the institution meets or could meet them. Market analysis is, in its simplest description, a more coherent way to plan institutional responses to conditions within the College's service area. Ihlanfeldt suggests a framework for the gathering and use of data. He states:

> There appear to be three basic components in the marketing of higher education: research, strategy and communication.
>
> Research involves discovering what people think of a given school and then developing a profile of the type of person who would be likely to enroll.
>
> Such an analysis of the potential student is necessary before a recruitment strategy can be developed, because that plan should answer the question: how can we contact the largest number of potential applicants in the most effective manner? If no research has been conducted, a school has only a vague notion of who its probable enrollees might be; this, of course, leaves success in recruiting to chance.
>
> Deciding on the type of communications to be used in recruitment is thus dependent on a college's strategy, which is, in turn, based on research. Communications should include not only the admissions office personnel, but also students, faculty, and alumni, all publications, and in general, any segment of the college with which potential students might have contact.[20]

Most postsecondary education was created to be responsive to the higher education needs of students immediately out of high school who would complete their education in an uninterrupted manner. Therefore, most colleges began their marketing efforts (research, strategy, and communications) with demographic data as it relates to secondary school systems. As the societal expectations of "equal educational opportunity" and "right to work" moved from concept to operational reality, colleges began to modify their marketing efforts to include categories of data beyond "traditional" high school graduates. As governmental and regulatory agencies began to legislate continuing education, colleges developed more specialized market segmentation efforts.[21] These efforts are now being extended to a broad range of agencies and organizations. (See Appendix C)

Diagnosis Preceeds Development

The purpose of the data gathering and analysis function is the gain insights into which of several options an institution will choose in charting a course of action over the next several years. Data from one source indicate that change in the number of high school graduates between 1979 and 1995 will range from a decline of 59% in Washington D.C. to an increase of 58% in Utah. Eleven states will experience a decline of more than 30% in the number of high school graduates during that period. Bowen indicates that colleges experienced enrollment declines in 1934, 1944, and 1952 and suggests four options: (1) redirect resources toward higher quality, (2) redirect resources toward research and public service, (3) redirect resources toward new student clientele, and (4) retrenchment.[22]

Standards and protocol for options 1 and 3 will differ widely and, therefore shall not be discussed in this paper. Frances lists twelve different strategies for increasing enrollment in colleges as follows:

> Increased high-school-graduation rates of students who would otherwise drop out
> Increased credentialing by testing of high school dropouts
> Increased enrollment of low- and middle-income students
> Increased enrollment of minority youths
> Increased enrollment of traditional college-age students
> Increased retention of current students
> Increased enrollment of adults
> Increased enrollment of women 20-34
> Increased enrollment of men 35-64
> Increased enrollment of graduate students
> Increased enrollment of persons currently being served by industry
> Increased enrollment of foreign students [23]

Redirecting resources toward research and public service deserves special comment because it represents an extraordinary challenge in strategic planning.

Strategic Planning and the Public Service Function

Technology transfer as a public service function for postsecondary education is an excellent example requiring strategic planning. Ultimate purposes of technology transfer include increased productivity, revitalization of the economy, and job creation.

Any discussion about technology transfer must begin with a definition of technology. Bugliarello offers a biosocial view of technology. He states:

> Technology is a process, it is a social process which generates and combines know-how and people in order to extend the physical range of man. The range, if you like, and power over muscles, over the brain, and over organs. Thus, technology is a people process; it's done by people and it enhances people.
>
> But it is also a biological process, because in enhancing people, it continues to be carried on outside of our bodies. And by now, really, to a growing extent, with pacemakers and artificial organs, also inside our bodies. It continues to carry out the process of evolution. Both as a people process and as a biological process, technology has been with us from the very beginning of our species some two million years ago. Thus, technology was born with people, technology has been developed by people and technology has affected people.[24]

Young says, "Technology is all the techniques, knowledge, lore, methods and tools that have helped society survive and improve its life."[25] Branscomb states, "Many people tend to think of technology as being embodied in the machines that we invent and use, but technology is certainly not machines. Technology is what people do with what they know."[26]

Ohio is a highly-industrialized state that is a national leader in fabricated metals, rubber, plastics, stone, clay and non-electrical machinery. The state, however, faces important economic challenges that include obsolescence in manufacturing facilities, decline in productivity, and below average growth in high technology and service industries. In order to meet these challenges and to provide a climate for business and industry which is supportive and conducive to expansion, the Ohio Board of Regents proposed and the Ohio Legislature funded the Ohio Technology Transfer Organization beginning with the 1979-1981 biennium. This state-wide network consisting of The Ohio State University and two-year institutions working with state and federal agencies is intended to provide small business and industry access to information, advice, and services that are essential to economic development and job growth.

To accomplish this purpose, a full-time technology transfer agent is located on each of eleven two-year college campuses and The Ohio State University. The primary function of the OTTO agent is to assume an active role providing technological assistance to constituents within a geographic region of the state. (See FIGURE 15) The OTTO agent, whose services are free, acts as a user broker in providing direct access to member colleges and OSU or to alternative sources of assistance. Typical cases might include obtaining information about plastics, corrosion, resource recovery, solar energy, or management assistance in areas such as inventory control, business record keeping, and general management. OTTO agents have access to computerized data bases which can be searched for recently published articles on almost any topic. Plans for the 1981-1983 biennium call for the addition of four institutions to the network and technical assistance on university campuses.

Major providers of research and development include the more than 200 Federal R & D laboratories and centers representing 11 Federal agencies in the Federal Laboratory consortium. (See FIGURE 16) If the intent is to reduce the lag between production of R & D and its application, it seems logical to bring together consumer and providers to discuss needs and products and then discuss brokering and networking. Such a program could be conducted on a national, regional, state, or local service area. If conducted on a large scale, consumers could specify the technological problems to be solved on the training programs that must be conducted to deal with such projects as the B-1 bomber, the Stealth bomber, the MX missile, the F-16 fighter, or the ELF communications system. Using the format displayed in FIGURE 17, diagnosis and specification of technological problems and training needs would be followed by presentations by R & D resource providers and that, in turn, by broker plans for networking. The model would also be applicable at the local level on a

FIGURE 16

FEDERAL LABORATORY CONSORTIUM

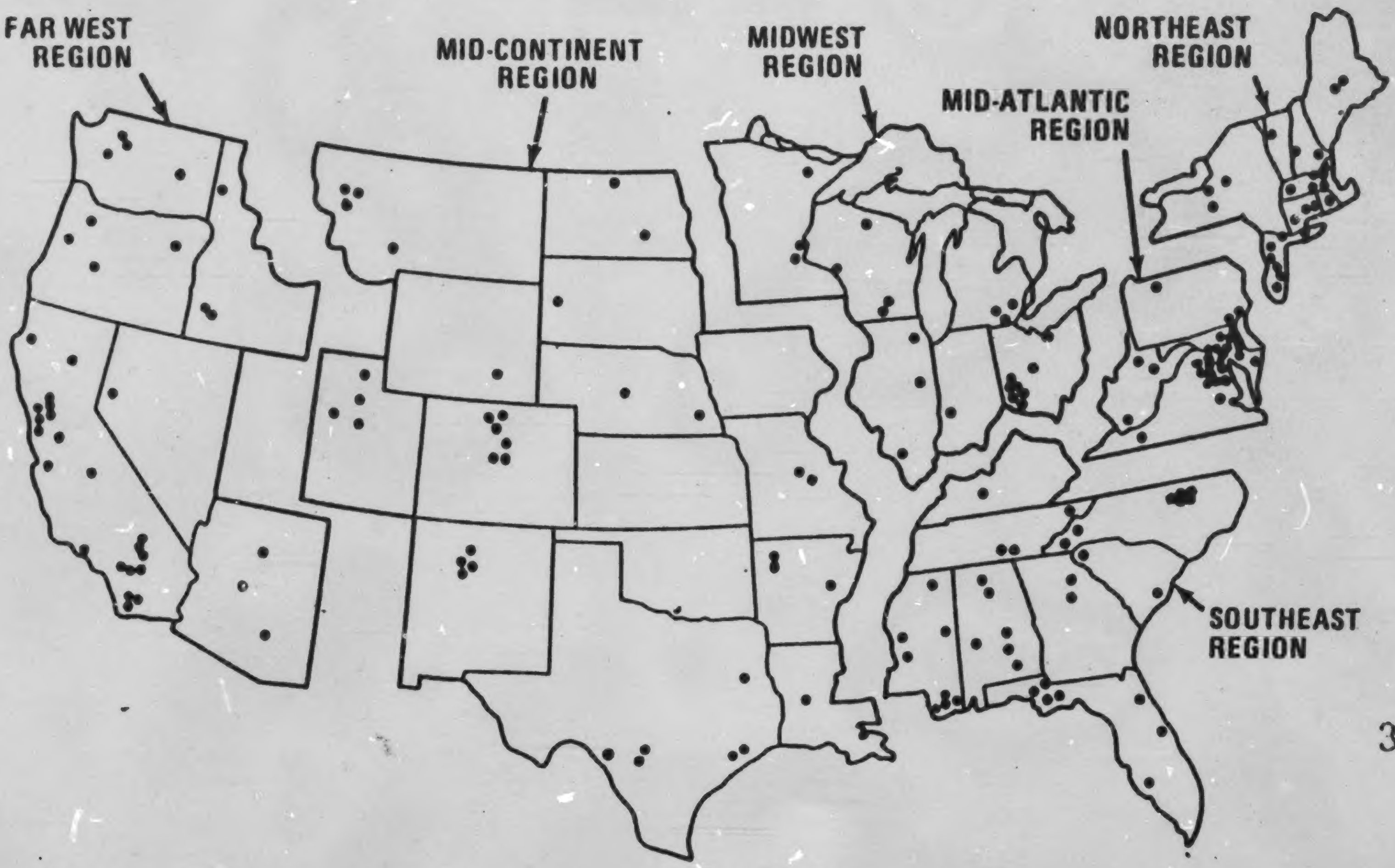

FAR WEST REGION
MID-CONTINENT REGION
MIDWEST REGION
NORTHEAST REGION
MID-ATLANTIC REGION
SOUTHEAST REGION

FIGURE 17

TECHNOLOGY TRANSFER CONFERENCE

SESSION	DAY 1 CONSUMERS	DAY 2 PROVIDERS	DAY 3 BROKERS
8:30-10:00			
10:15-11:45			
12:00- 1:30			
1:45- 3:15			
3:30- 5:00			
6:00- 7:00	RECEPTION	RECEPTION	
7:00- 8:00	DINNER	DINNER	
8:00- 9:30			

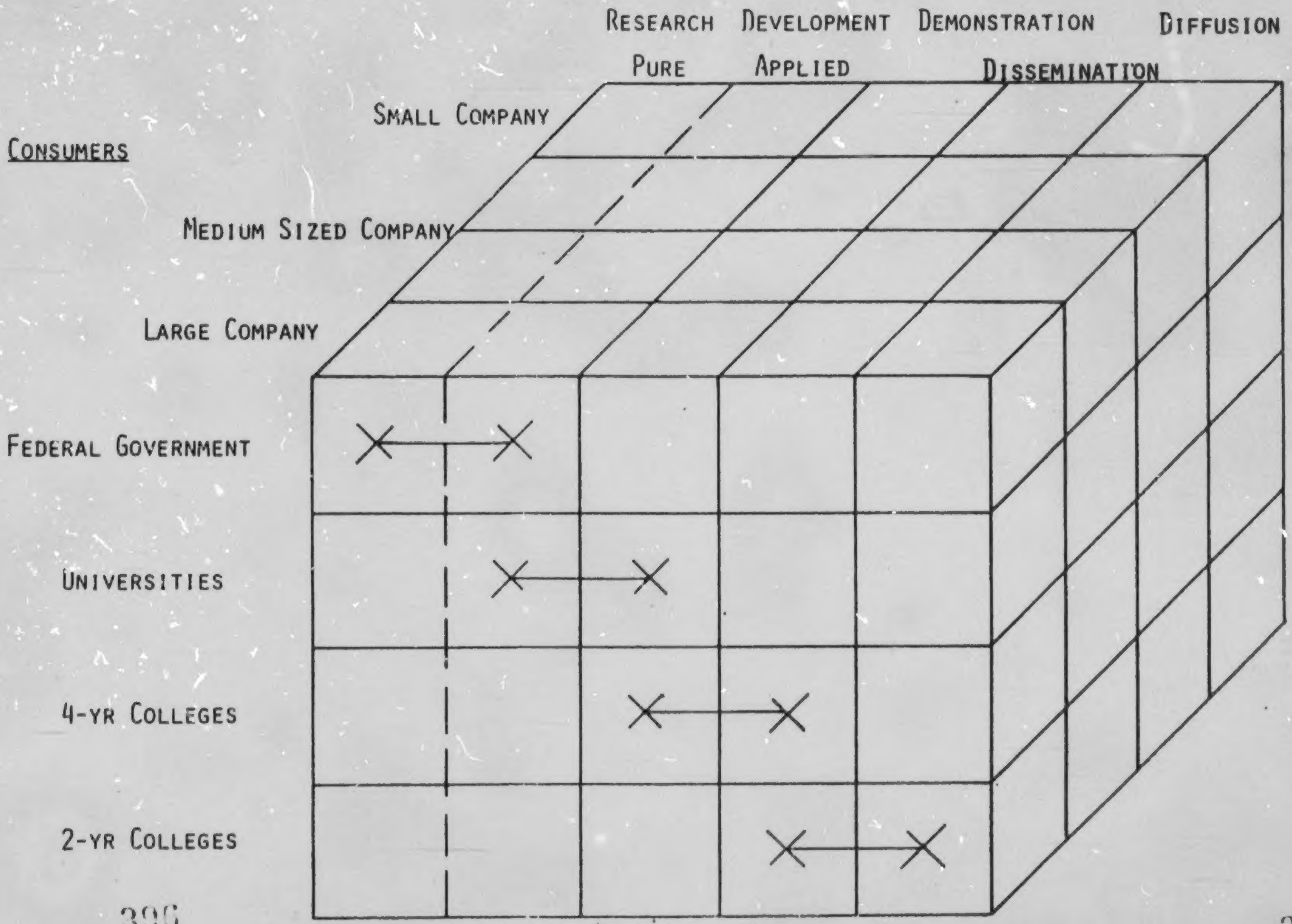
smaller scale. These deliberations should result in clearer delineation of the continuum extending from "pure" research through its application, the needs of a variety of types of consumers, and the unique role that different types of postsecondary education institutions can play in increasing productivity, revitalization of the economy and job creation, (See FIGURE 18) These deliberations would have tremendous implications for the way in which we structure our organizations, the use of advisory committees,[27] and such functions as institutional research.[28]

In conclusion, the future of postsecondary education rests on the degree to which it meets the needs of the society in which it exists. As society changes, so must postsecondary education change. The way in which a specific college or a statewide system meets the challenge of being responsive to societal needs is a function, for the most part, of its sophistication in planning. Whatever our course of action, a statement from Three Thousand Futures is most appropriate:

> The future holds many unknowns. It also holds a range of already known choices that can be made by those making decisions about higher education.... External, particularly market, pressures will not alone lead to the best results. Internal thought, resolution, and determiniation are needed to assure that higher education as a whole and institutions individually reach 2000 with capacity to perform undiminished or minimally diminished by the demographic depression. The surrounding environment in the next 20 years will create some special problems that we can already see. It does not, however, determine in advance how well these problems will be solved or how inadequately human choice, or absense of choice, will settle that. A downward drift in quality, balance, integrity, dynamism, diversity, private initiative, research capability is not only possible--it is quite likely. But it is not required by external events. It is a matter of choice and not just of fate. The emphasis should be on "managing of excellence."[29]

FIGURE 18

RESEARCH AND DEVELOPMENT/DIFFUSION CONTINUUM


RESEARCH
PURE
DEVELOPMENT
APPLIED
DEMONSTRATION
DISSEMINATION
DIFFUSION
CONSUMERS
SMALL COMPANY
MEDIUM SIZED COMPANY
LARGE COMPANY
FEDERAL GOVERNMENT
UNIVERSITIES
4-YR COLLEGES
2-YR COLLEGES

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NOTE: APPENDICES A, B and C are available at no charge upon request from the CAUSE National Office.

Relief from "The Great Paper Chase" and Other Office Miseries

by

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John S. Wasileski

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Have you or your staff ever spent fruitless hours searching through files for a report, memo, or letter you just knew was there ... somewhere?

When was the last time you 'burned the midnight oil' manipulating data and calculating summaries for a report and later discovered, quite by accident, that your files already contained a report you could have used ... if only you had known it was there?

These problems are quite common and our experience has been that no physical arrangement of the files will long alleviate the frustrations caused by these situations, yet the human resources of an office are too precious (and expensive) to be wasted in the meaningless 'paper chases' which can result.

The article describes the device we designed to chase paper for us ... INDEX, an interactive retrieval program which is easy to use and maintain, can locate sources of information from a general description of the kind of information needed, requires only a modest investment of time, and is widely applicable.

Have you or your staff ever spent fruitless hours searching through files for a report, memo, or letter you just knew was there ... somewhere?

When was the last time you 'burned the midnight oil' preparing a report and later discovered, quite by accident, that your files already contained a report you could have used ... if only you had known it was there?

These two situations are, unfortunately, typical in most offices and occur (especially the first one) with great regularity. Both are expensive - they are frequently responsible for 'redos' and the annual cost of having people continually searching for lost documents can be staggering. Perhaps the greatest cost, however, is the waste of human resources which are far too precious to be expended in the frustrations which result from meaningless "paper chases".

Pepperdine University's office of Institutional Research & Planning prepares approximately 300 reports each year and about two years ago began experiencing an uncomfortable increase in the incidence of these two problems. Our first remedy was, of course, a new filing system. The idea was to file by content and date. It never really worked because so many of our reports contain a variety of information and could have been filed several ways. We contemplated cross-filing but realized it would be too expensive and would require too much space. Our last attempt using a 'physical file' solution was multiple indexing - to be kind, it was a complete disaster.

Physical filing system just won't work. At least, this is the conclusion we eventually drew and we had, by this time, been able to identify three reasons why they do not work:

1. Physical filing systems require a relatively rigid format (e.g. alphabetized by 'name' or sequenced by 'number') but most documents contain such a variety of information that they could easily be filed in several places.
2. Despite all efforts to the contrary, filing systems are 'person dependent'. That is, any system for filing requires a judgment be made as to where a particular document 'fits' in the system. Unfortunately, the judgment of the person looking may be different from the judgment of the one filing. Even if the same person does both, finding files is heavily dependent on human memory.
3. Physical systems have limited expandability and can require major restructuring if they outgrow their alloted space. (Microfilming can alleviate this limitation but can do nothing about the other two).

When viewed in this way, it becomes clear that what was needed was not a filing system but rather a way of retrieving documents which is independent of judgment, memory, and the physical structure of the filing system. Such a scheme required a careful study of the kind of information people have when they begin searching for a document.

"Say, where's that report whatshisname did a couple of months ago that had those budget figures?"

Sound familiar? We think it is typical of the kind of question which prompts a 'paper chase'. Perhaps the best one-word description of such questions is 'fuzzy'. People ask fuzzy questions but expect clean shaven answers. In most questions, however, some things are less fuzzy than others - for example, in the question above, the name of the person responsible for the document is completely out-of-focus but the time period ("...a couple of months ago...") is substantially less fuzzy. Moreover we know it is a report and that it contains budget information. Armed with just this much knowledge most of us would begin searching the financial section of our files even though it may well be that the "budget figures" were only incidental in the report. This initial search routine would be 'normal' for, in our examination of about two hundred questions which initiated file searches, we found that in nearly every case the description provided was partial content. That is, most requests to retrieve a document describe the document in terms of the kind of information it contains. Other descriptors used are partial titles, various dates, associated offices or organizations, and names of individuals connected with the documents. We also observed that these secondary bits and pieces of information can be invaluable in the search.

From the observations it followed that we needed a simple but accurate scheme for classifying all the information on a document as well as other, more direct, descriptions. The system we decided upon relied on careful study of our most complex reports and the following conclusion resulted: "information" usually means 'facts' about specific areas of operation. These 'facts' can nearly always be considered as a measurement made to some level of detail - otherwise the 'facts' are narrative or commentary in nature.

We implemented this observation by designing a segmented computer record. Every record contains an information segment for each of our operational areas. The areas we used are: Student , Faculty, Staff, Financial, General University Information, and Miscellaneous. Each information segment is 15 characters long; the first 3 characters contains the measurement being made (e.g. HCT - Headcount, REX - Revenue & Expenses, etc.), the next 12 characters are two-character codes for up to 6 levels of measurement details. For example, one of our reports contains a table showing the number of male and female students within each ethnic category across the academic departments and schools of the University. This is coded as | HCT | SC | DP | ET | SX | | | . The 240-character record is diagramed in figure 1.

Our initial intention had been to use the file-editing capabilities of the Sperry-Univac 90/80 to search the file described above. We soon discovered that its limitations were far too confining for our needs and we began to investigate the purchase or development of a 'bare bones' retrieval package. We already had Mark IV and similar devices - what we wanted was something interactive and user friendly (translated: really quick and easy to use!). Our request stirred some interest in the 'technical camp' - this was probably due to their view of the 'simplicity' of our specifications. All we wanted was some retrieval software which:

1. Had no preconceived file structure.
2. Had no prescribed output format.

3. Had complete freedom in length and complexity of selection statement.
4. Had a simple, easy-to-use syntax.
5. Was interactive.

and 6. Was capable of quick changes and enhancements without 'red tape'.

As Lee Smith, our technical support director, later remarked, "...that isn't software - its mushyware." 'Mushyware' is really an excellent description for what was finally developed because it is so soft that even a beginner can 'mold' it without difficulty. Over the next few weeks Lee developed a program using the VS9 Text Editor of the Univac - we called the program INDEX.

INDEX is surprisingly versatile, interactive retrieval package - it can be used with any data file and the user need only supply a data-element dictionary (which can be dynamically created or altered). There are no limits to the complexity or length of the selection statement and the syntax has the simple form: VARIABLE NAME, RELATION, VALUE. Compound statements are made using the usual connectors (& = and, * = or, \ = not) but one of the best features of INDEX is the simplicity yet wide applicability of the standard relationals; they are listed and explained in Table 1. It will also be possible soon for users to interactively define and preserve their own relationals.

It took about two months to develop INDEX and (simultaneously) create the data file for our office report files. Shortly after we finished we got an opportunity to test both INDEX and our concept for

TABLE 1 Standard Relational Symbols in INDEX

SYMBOL	EQUIVALENT SYMBOL(S)	RECORD IS SELECTED if the field referenced by the 'variable name' contains ...
=	EQ	exactly the value listed.
[		all of the values listed.
]		any of the values listed.
>	GT	any value following* the value listed.
<	LT	any value preceeding* the value listed.
>=	=>,GE,EG	any value equal to or following value listed.
<=	=<,LE,EL	any value equal to or preceeding value listed.
<>	><,NE,NEQ	any value not equal to the value listed

* In either an alpha or numeric ordering.

document retrieval; our vice-president's office called with an urgent request to locate a copy of an article which had been received and filed a few weeks before. All we were told was that it was "...that article on 'listening'." Example 1 is a copy of the actual 'run' used to find the article. The entire process took about ninety seconds and, as the output shows, the document was in file #900546, cabinet C, slot #1. It had been nearly impossible to find without INDEX because it had been filed in a folder marked Sperry-Univac - apparently because it had been presented at a Sperry-Univac seminar.

EXAMPLE 1

```
/DO PRO.INDEX
◆◆◆>:DR
◆◆◆>:RE
->:NAM [ LISTEN

900546      1C1            MANAGERIAL TIPS LISTENING
```

A few days later we were asked to prepare a report comparing the University's budgets for fiscal years 1980 and 1981. Example 2 is the list of files identified by INDEX as containing relevant information. Some of these files would have been checked without INDEX but three of them would probably have been overlooked and one of these (#001475) already contained the report requested. This INDEX run took about three minutes and saved two full days redoing a report.

EXAMPLE 2

```
◆◆◆>:RE
->:FIM = BUD & FIP ] 80,81

900602  1C3                  BUDGET SUR U OF SAN FRANSISCO

001595  1C3  CON ENROLL      FIN/ENROLL & PRES. BUD CUT

900613  1C3                  COMPUTER COMP BUDGET PERSONNEL

900888  1C3                  EFPM BUDGET MODEL SAMPLE RPT

900890  1C3                  BUDGET MODEL AFTER ADJUSTED

000428  1C2                  NACUBO WORKBOOK REPORTS

900954  1C2  BUDGET/ACTUAL   FISCAL YEAR BUDGET FINAL REVIEW

000486  1C2                  BUDGET REQUESTED FY 1981

001525  1B9  CASH-FLOW       EFPM DECISION MODEL FOR LOAN OP

001475  1B9                  EFPM BUDGET MODEL UPDATES

001476  1B9                  EFPM ZBB MODEL RUN PERIOD 81-85

001468  1C3                  ZBB BUDGET/FILE 1981-1982

001419  1C3                  CASH FLOW RUNS FINANCE MEETING
```

Sometimes a problem is given a solution which is larger and more general than the original problem required. This is the case with INDEX; after a brief demonstration was given at a staff meeting other offices began adopting and adapting immediately. The Registrar's Office is INDEXING its microfilmed student records so that anyone in the office can locate a record by specific fiche page and file drawer. Up to this time they had been using hand written lists. The program office of our School of Education created a data file containing curriculum information on each student. They use INDEX to plan course offerings by location and can easily produce potential class lists for each course. The Admissions Office is using it for some, as yet undisclosed, application and, of course, it is also nice that the original problem seems to be solved. We have nearly forgotten the feelings of embarassment and frustration at being unable to find something "...we just know is there...somewhere."

TABLE DRIVEN GENERAL LEDGER SYSTEM FOR FUND ACCOUNTING

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STATE OF MISSISSIPPI
JACKSON, MISSISSIPPI

The Board of Trustees of State Institutions of Higher Learning, State of Mississippi, has developed a general ledger and budgeting system for use at state-supported universities in Mississippi. This system was developed with considerable input from the staff and managements of the universities. The COBOL programs that constitute the system utilize external (mass storage) table to define (1) valid account numbers, (2) format and content of input transactions, (3) edit criteria for these transactions, and (4) "posting" processes. The system is designed to translate all input into one journal file for all "ledgers". The system maintains current balances of selected "ledgers" on mass storage but all reporting is done utilizing the common journal file, reference tables, and a COBOL based report-writer system.

The system is highly adaptable due to its table-driven design. The tables themselves are also user adaptable because reference table maintainance, content, and use are defined within the tables. This flexibility is necessary to interface to existing "feeder" transactional systems with minimum COBOL code modification. Although the system is designed for our chart of accounts, the system is easily adaptable to other charts of accounts.

A TABLE DRIVEN GENERAL LEDGER SYSTEM FOR FUND ACCOUNTING

The Financial Accounting System (FAS) is a computerized General Ledger/Department Ledger system for recording university financial transactions for reporting purposes. This package was developed in 1980-81 by the Mississippi Board of Trustees of State Institutions of Higher Learning - MIS Project financial accounting team in cooperation with the financial and data processing personnel from the state's universities. FAS was developed to be installed in any of the state's universities to provide them with a General Ledger/Department Ledger system for use as a tool for internal and external reporting, especially to the Board of Trustees.

The system utilizes the Board of Trustees' adopted chart of accounts numbering of 18-digits, structured as follows:

xx	Fund
xx	General Ledger Code
xxxx	General Ledger Detail Code
	Object Code (for GL Codes 40, 45, and 50)
	Revenue Code (for GL codes 30 and 35)
xxxxxxx-xxx	Department Project Code

These codes are defined in the Board of Trustees' Uniform Reporting and Chart of Accounts Manual. However, with minor modifications, FAS can handle any chart of accounts numbering regardless of size or structure.

The computer equipment on the campuses includes mainframes from various vendors--IBM, NCR, UNIVAC, XEROX. The size of the professional data processing staffs on the campuses also varies greatly. These two areas of diversity required that the system be easy to install on multiple systems and interface with existing accounting transaction systems such as cash receipts, purchasing, and cash disbursements.

The volatility of financial reporting requirements is a problem in most areas of higher education. This system addresses this problem by basing almost all reporting on a common-format general journal concept rather than on a traditional set of fixed ledgers. Reporting is accomplished via a COBOL-based report writer called MIS-Reporter which was also developed by Board of Trustees staff.

FAS Features

The design limitations placed on the Financial Accounting team also contributed to the advantages featured in FAS. Some of the features of FAS are listed below:

1. Table driven to allow customization with minimal programming effort. These tables enable FAS to accept input transactions in the user's original input form and to tailor editing of each segment of the input. This flexibility on the input side enhances the mobility of FAS and facilitates the initiation and operation of the system.
2. User batched transactions as original input. These transactions can be in detail or summary forms, depending on the needs of the user and the capabilities of their input systems.
3. Comprehensive edit of these input transactions and "explosion" into appropriate accounting transaction entries utilizing the full 18-digit coding block.
4. Accounting Transactions Journal File to post the "exploded" accounting transaction entries (debit and credit) with these features:
    a. always in balance due to required balanced double-entry posting for all transactions;
    b. automated journal of all financial activity;
    c. elimination of need for internally structured general ledgers and departmental ledgers, which require continual maintenance and balancing,
    d. 18-digit structure of posted entries for reporting purposes.
5. Management hierachical reporting capabilities.
6. Table-driven association of user defined data with each transaction for special reporting requirements.
7. Maintenance of various user defined ledgers to meet "daily" reporting needs, e.g., departmental free-balance ledgers, 18-digit and 8-digit general ledgers, and bank balance ledger. These ledgers could be available for on-line inquiry.
8. Maintenance of an outstanding encumbrance ledger.
9. Simple easy-to-follow audit trail and transactional activity reports.
10. Report writer facility to allow users and data processing personnel to produce internal and external standard, ad hoc, and specialized reports.

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11. Standard monthly reports to meet the institution's minimal reporting needs. With all reports are divided into report series to facilitate an understanding of their uses.
12. Capability to provide historical financial detail to a budget modeling and preparation module, and also to accept approved budget entries from the module.
13. Project accounting with capability of maintaining special fiscal years and total project information for contracts and grants.
14. Table maintenance capabilities by users in transactional form with table maintenance reports provided for reference and audit trail.
15. Capability to accept current month input and process it even though prior month, months, or year have not been closed. "Process" is used to mean performing edit and "explode" functions only. This enables input systems to maintain production cycles regardless of closing status.
16. Batch balancing and batch control.
17. Access to prior years' annual, monthly, and year-to-date totals and detail.
18. Standard rule within system that all debits are positive (+) and all credits are negative (-) to avoid confusion. However, report capabilities allow suppression of sign as desired by users.

Documentation

A Financial Accounting System User Manual has been written for the non-data processing and data processing users of FAS. The documentation is divided into four sections because these are the areas of a computerized system which a user sees. An understanding of the features and capabilities previously listed provides the user with a sufficient basis for effectively using FAS.

The four sections of this manual are as follows:

1. Input Section - This defines and describes in detail the input transactions types and documents used by the user for entering financial transactions into FAS. Since FAS utilizes the institution's already existing input forms, modes, and documents, this section is unique for each institution (see Appendix I for example pages).

2. Reports Section - This defines and describes in detail the report series used in FAS and the reports within each series. This section covers both FAS standard reports and the institution's additional reports.
3. Tables Section - Since the tables are an integral part in the operation of FAS and are the accountant's "hand" in the computer processing of financial transactions, this section organizes and explains the type of tables for the institution, and lists the tables currently within FAS. Each table "layout", or format, is explained to enable the Accounting Department to read and understand the content of the table listings. A valuable part of this section will be a set of instructions outlining the procedures for updating the table contents.
4. User Procedures - The successful operation of FAS from the Accounting Department depends on the proper handling of transactional documents and reports in a timely fashion. Thus, the procedures used must link with the pieces of FAS described above. This section allows the institutions to document their procedures desired in each subsystem, i.e., cash receipts, purchasing, etc., and to relate each procedure to input forms, reports, and tables of FAS. The full documentation of user procedures and their relation to the input, report, and table sections provides a complete picture of FAS and its operation within the Accounting Department.

Within each section a set of instructions is provided on the proper completion of documentation forms. This is to encourage each institution to properly maintain the level of documentation to coincide with the current system. As input forms, reports, tables, and procedures are changed, documentation changes should be made to reflect these system changes. This manual is designed for such uses as 1) a training manual, 2) a system analysis tool, and 3) a periodic reference manual.

The manual provides the Accounting Department's link with the computerized areas of FAS. An understanding of this manual will give the non-data processing users a very useful tool for doing their jobs more efficiently, accurately, and timely. Thus, FAS is a system that works for the user with the needs of the user always in mind.

Conclusion

The system is currently being installed on two of our campuses.

The system is highly adaptable due to its table-driven design. The tables themselves are also user adaptable because reference table maintainance, content, and use are defined within the tables. This flexibility is necessary to make possible interface to existing "feeder" transactional systems at the universities with minimum COBOL code modification. Although the system is designed to implement the chart of accounts developed for use in our institutions, the system is easily adaptable to other charts of accounts.

Appendix I

Financial Accounting System Input

The Financial Accounting System (FAS) is a "transaction-driven" system, which means it requires the input of transactions for it to work. The processing and posting of these input transactions to make available data for reporting "drives" the daily routines of the system.

Input transactions can generally be grouped within the following transaction types for a typical institution:

Cash Receipts
Cash Disbursements - Encumbered
Cash Disbursements - Unencumbered
Encumbrances
Budget Entries - Original and Revisions
Payroll Entries
Journal Entries
Table Maintenance Entries

Depending on the processing of transactions by the institution, these transaction types may be combined or further sub-divided. Usually each transaction type will require a separate or uniquely completed transaction form.

This section of the manual provides an explanation of the transaction types input to FAS and a detailed description of the input forms. The following format is utilized in this section:

1. Listing of input transaction types for institution.
2. Description of each transaction type and a listing of the input documents completed.
3. Input Form Description - This form provides basic information about each input document, as well as the detail contents referenced to the document copy.
4. Copy of input document with each input field referenced to the Input Form Description on which the field contents are detailed.

Instructions for preparing the Input Form Description form are provided at the end of the input section. These may be utilized whenever input modifications are made or new input forms are added.

FINANCIAL ACCOUNTING SYSTEM

EXAMPLE LISTING OF INPUT TRANSACTION TYPES

INPUT TRANSACTION TYPE	INPUT LAYOUT	INPUT DOCUMENT
A. Original Budget (BU)		
1. Expenditure Allocation - BU1	BU	BU001
2. Estimated Revenue - BU2	BU	BU001
B. Budget Revision (BR)		
1. Expenditure Allocation - BR1	BR	BR002
2. Estimated Revenue - BR2	BR	BR002
C. Cash Disbursement Corrections (CD):		
1. Expense - CD1	CD	CD004
2. Revenue - CD2	CD	CD004
3. Other - CD3	CD	CD004
4. Cash Entry - CD4	CD	CD004
D. Cash Receipts (CR):		
1. Revenue - CR1	CR	CR005
2. Refunds - CR2	CR	CR005
3. Receivables - CR3	CR	CR005
4. Assets - CR4	CR	CR005
5. Cash Entry - CR5	CR	CR005
E. Encumbrances (EC):		
1. Expenditures - EC1	EC	EC006
2. Travel - EC1	EC	EC010
3. Corrections - EC2	EC	EC006
F. Journal Entries (JV)	JV	JV007
G. Cash Disbursements (PO):		
1. Assets - POA	PO	PO008
2. Expenditures (POB):		
a. Unencumbered - PO1	PO	PO008
b. Encumbered (partial) - PO2	PO	PO009
c. Encumbered (full) - PO3	PO	PO009
3. Refund - Agency - PO4	PO	PO008

	INPUT TRANSACTION TYPE	INPUT LAYOUT	INPUT DOCUMENT
	4. Refund - Student - PO5	PO	PO008
	5. Refund - Revenue - PO6	PO	PO008
	6. Refund - Fund - PO7	PO	PO008
	7. Liabilities - PO8	PO	PO008
	8. Transfers - PO9	PO	PO008
H.	Payroll (PR)	PR	Payroll
I.	Batch Control	*	BH003

*Because the batch control is used with all the above input transaction types, the appropriate transaction code is input on the batch header card, card "B".

Appendix B

Financial Accounting System Reports

This section of the manual provides a detailed description of the Financial Accounting Systems' (FAS) report series and on each report within the report series.

The reports are separated into report series to provide for easy identification of a report type and to facilitate the understanding of how the reports fit into FAS. The report series provided are listed below:

1. E Series - Edit, Error, and Audit Control Reports
2. D Series - "Daily" Informational Reports
3. M Series - Monthly Management Reports
4. C Series - Controller's Monthly Reports
5. P Series - Monthly Project Reports
6. X Series - Board of Trustees Reports
7. A Series - Annual Financial Statements
8. S Series - Schedules to the Annual Financial Statements

The reports section is divided into each of these series. The first page of the series describes the purpose of the reports within that series. The remainder of the series section provides a detail description of each report, utilizing the following three documents:

1. Financial Accounting Report Description - This form provides basic information about the report and its uses.
2. Report Contents - This form details each report field on the report to inform the reader of the contents of the report. Each content description is referenced to the report copy.
3. Copy of report with each report field referenced to the report contents.

Instructions for preparing the report description and the report contents forms are provided at the end of the report section. These may be utilized whenever report modifications are made or new reports are added.

All report numbers are prefaced by "GL" to denote these reports as originating from the Financial Accounting System (General Ledger), distinguishing them from the user's other systems. The next letter represents the report series within which the report is classified. The last two numbers identify the report number within the report series. This numbering scheme should be followed when adding additional General Ledger reports.

Listing of Financial Accounting System (FAS)
Report Series and Reports

Edit, Error and Audit Control - E Series

- GL-E01 - Reference Table Maintenance Listing
- GL-E02 - Batch Error Report
- GL-E03 - Batch Transaction List
- GL-E04 - Batch Control/Edit Summary List
- GL-E05 - Posting Audit Control Report - Work File
- GL-E06 - Posting Audit Control Report - Accounting Transactions File

"Daily" Informational Reports - D Series

- GL-D01 - Daily Departmental Free Balance Report
- GL-D02 - General Ledger Balances - 18-Digit
- GL-D03 - General Ledger Balances - 8-Digit
- GL-D04 - Bank Balances Report

Monthly Management Reports - M Series

- GL-M01 - Management Hierarchical Expenditure Report
- GL-M02 - Monthly Department Ledger Statement
- GL-M03 - Monthly General Ledger Trial Balance, Pre-Closing
- GL-M04 - Monthly General Ledger Trial Balance, Final
- GL-M50 - Departmental Encumbrance Summary by Fund
- GL-M51 - Statement of Revenue - All Funds
- GL-M52 - Monthly Transaction Recapitulation

Controller's Monthly Reports - C Series

- GL-C01 - 8-Digit General Ledger Summary
- GL-C02 - Monthly Cash Report
- GL-C03 - Monthly Bank Report
- GL-C04 - Monthly Investment Report
- GL-C05 - Departmental Ledger Summary
- GL-C06 - Monthly Revenue Summary
- GL-C07 - Monthly Expenditure Summary
- GL-C50 - Expenditure Comparison Report

Monthly Project Reports - P Series

- GL-P01 - Monthly Project Summary
- GL-P02 - Monthly Project Ledger Statement and Summary
- GL-P03 - Monthly Letter-of-Credit Informational Report
- GL-P04 - Monthly Proration Report

  - GL-P05 - Monthly Restricted Fund Adjustment Report
  - GL-P05 - Indirect Costing Report
- Board of Trustees Reports - X Series
  - GL-X01 - Monthly OPRS - 152
- Annual Financial Statements - A Series
  - GL-A01 - A. Statement of Financial Condition
  - GL-A02 - B. Statement of Changes in Fund Balance
  - GL-A03 - C. Statement of Current Funds Revenues, Expenditures, and Other Changes
  - GL-A04 - D. Statement of Changes in Fund Balances - Unrestricted
  - GL-A05 - E. Statement of Cash Summary
- Schedules to the Annual Financial Statements - S Series
  - GL-S01 - I. Schedule of Current Fund Revenues
  - GL-S02 - II. Schedule of Current General Funds Expenditures
  - GL-S03 - III. Schedule of Current Fund Expenditures
  - GL-S04 - IV. Schedule of Current Auxiliary Enterprises Fund
  - GL-S05 - V. Schedule of Changes in Fund Balances - Current Restricted Fund
  - GL-S06 - VI. Schedule of Changes in Fund Balances - Loan Funds
  - GL-S07 - VII. Schedule of Changes in Fund Balances - Endowment and Similar Funds
  - GL-S08 - VIII. Schedule of Changes in Fund Balances - Unexpended Plant Funds
  - GL-S09 - IX. Schedule of Changes in Fund Balances - Renewals and Replacements
  - GL-S10 - X. Schedule of Changes in Fund Balances - Retirement of Indebtedness
  - GL-S11 - XI. Schedule of Changes in Fund Balances - Net Investment in Plant
  - GL-S12 - XII. Schedule of Changes in Fund Balances - Agency Funds
  - GL-S13 - XIII. Schedule of Investments - All Funds
  - GL-S14 - XIV. Schedule of Long-term Indebtedness
  - *GL-S15 - XV. Schedule of Land Inventory
  - *GL-S16 - XVI. Schedule of Building Inventory
  - *GL-S17 - XVII. Schedule of Departmental Equipment Inventory

*GL-S18 - XVIII. Schedule of Improvements Other Than Building Inventory

GL-S19 - XIX. Schedule of Transfers

GL-S20 - XX. Schedule of State Building Commission Allotment Receivable

* To be prepared by Fixed Assets System

Appendix III

Financial Accounting System Tables

The uniqueness of the Financial Accounting System (FAS) is in the table concept of carrying variable information in tables, or files, within the computer system. The advantages of this table concept are:

1. Flexibility to allow for the ever-changing environment of the university.
2. Faster and easier changes to the system by reducing the programmer/analyst involvement.
3. Tailoring capabilities for handling each processing situation.
4. Enhanced editing capabilities for each input segment of the transaction to provide more indepth editing rather than blanket editing.

The tables used in FAS are grouped within the following categories:

1. Transaction Tables - These tables define the input format, editing requirements, and entry explosion for all financial input transactions entering FAS. These inputs and transaction types are described in the input section.
2. Error Message Table - The error message number, severity, and narrative are contained in this table for reporting all possible edit errors desired by the user.
3. General Ledger Tables - These tables define the numbers and descriptions of all parts of the general ledger number. Separate tables are provided for fund, general ledger, general ledger detail, nue, object, and department codes.
4. Posting/Reporting Tables - These tables define the criteria for posting and reporting the information on the Accounting Transactions Journal File, including the management hierarchical codes table.

This section of the manual provides the organization of the FAS tables with a detailed description of each table. The following form is utilized in this section:

1. Listing of tables by table category.
2. Description of table categories.
3. Table Description - This form provides basic information about each table, including format, description, and maintenance criteria.

Detailed table values are maintained as separate listings in the Accounting Department and should be studied for a complete understanding of what is contained in the institutions tables. This section only identifies those tables which are in the FAS and how to read them.

Listing of Tables by Table Category

The following provides a listing of the type of tables included in the Financial Accounting System. They are put into categories to aid in understanding the functions of each table.

Transaction Tables:

TA0 - Input transaction type description;

TA1 - Input definition and sources of input transaction type;

TA2 - Input definition, edit, and explosion requirements for each field (block of data) defined in the TA1 table record of the input transaction type;

TA3 - Additional and more complete edit requirements defined for the input field addressed in the TA2 table record.

Error Message Table:

TM1 - Contains the error messages, severity, and numbers defined for the error conditions which may result from the edits on Tables TA1, TA2, and TA3.

General Ledger Tables:

TF1 - Defines the fund codes - 2 digits

TL1 - Defines the general ledger codes - 2 digits

TG1 - Defines the general ledger detail codes - 4 digits

TG2 - Additional record area for defining the general ledger detail codes

TR1 - Defines the revenue codes - 4 digits

TR2 - Additional record area for defining the revenue codes

TO1 - Defines the object codes - 4 digits

TO2 - Additional record area for defining the object codes

TD1 - Defines the department and project codes - 10 digits

TD2 - Defines additional department and project information

TD3 - Defines project information

Posting/Reporting Tables

TS1 - Defines MIS transaction codes

TH1 - Defines management hierarchy reporting - 16 digit numbers

TJ1 - Defines bank reference codes - 2 digit numbers

TK1 - Defines letter-of-credit reference codes - 4 digit numbers

Transaction Tables

Purpose:

The transaction tables category defines the input transaction types which will be entering the Financial Accounting System (FAS), as described in the input section of this manual. The desired edits and the resulting "exploding" of the input data for each input transaction type are also defined in the transaction tables.

Tables:

1. TA0 Tables - For each input transaction type defined in the input section, giving the descriptive name to be associated with the input transaction type.
2. TA1 Tables - For each input transaction type defined in the input section. Each TA1 table record defines the input transaction for FAS with such data as the number of fields of input data being entered, the number of exploded transaction entries desired from the input, the type input data being entered (batch header, transactional), batch control information, and the source of the input data (direct from cards or files, indirect).
3. TA2 Tables - For each input data field entered, as denoted on the TA1 table record for the input transaction type. These tables define each input field as to its source, type, location, size, key identifier, and sign. The common field edits and associated error message are also defined. The resulting piece of the "exploded" entries in which the data field is desired is also defined.
4. TA3 Tables - For each additional series of edits desired for the input data field defined in the TA2 table record. These edits are usually more complex than those in the TA2 table record, allowing more flexibility and also providing access to data contained on other computer files. Examples of these edits are:
    a. Verification of data values or ranges
    b. Automatic assignment of a constant value to the "exploded" transaction entry
    c. Branching to edits defined on other TA3 Table Records
    d. Reference to other internal computer edits.

Accounting:

The setup of the Transaction Tables within FAS is to provide for more flexibility in the system. This flexibility embraces the following:

1. The original input forms can be used in inputting transaction data into FAS.
2. Tailored, comprehensive edits can be applied to each portion of the input data to meet each situation's needs.
3. The "explosion" of the transaction (debit and credit) entries can be defined for proper recording by the chief accounting personnel. Thus, proper recording of transactions does not depend on clerical decisions and consistency.

For every input transaction type defined in the input section, a TA0 and a TA1 table record are maintained. If additional input transaction types are added, then additional TA0 and TA1 cards are needed. If changes are made to the input cards, records, etc., which enter the input transaction data, then the transaction tables need to be changed to reflect this. When changes are made to the tables, a Report GL-E01 is generated.

The same number of TA2 table records are maintained as the number of fields specified in record columns 11 - 12 on the TA1 table records for the input transaction. Thus, if the TA1 table record for cash receipts -revenue specifies 12 fields of input data (date, amount, cash receipt number, fund code, revenue code, etc.), then there will be 12 TA2 table records, one for each input data field. The "exploded" entries will be pieced together from the edited data fields of the TA2 cards. This is the Acccounting Department's "arm" in FAS to insure the proper recording of all transactions in the way they want them recorded.

Although not always required, TA3 table records are prepared in connection with the TA2 table records on the input data fields. (TA3 table records may be prepared with TA1 table records under special circumstances when TA2 table records are not required.) The number of TA3 table records within each TA2 table record is limited to 98 (02 - 99), which is more than sufficient for defining edits for each input data field.

The significance of the transaction tables to the Accounting Department is that these tables handle accounting information in FAS according to the desires of the accountants.

1. FAS accepts the accounting transactions in the form and manner in which the accountants have specified.
2. FAS edits the transactions in the manner in which an efficient and accurate accountant would want them, checking all available sources within the computer files.
3. FAS prepares the "Journal Entries" to record the accounting transactions with the proper account number on each debit and credit entry, and reference information for a clear audit trail. Thus, the recording of the transaction entries follows the commands of the accountant, insuring the proper recording as if the accountant is personally involved in every transaction.

Thus, when the accountant understands the transaction tables and knows their contents, FAS becomes an effective working partner to the Accounting Department.

UNIVERSITY STORES
AN INTEGRATED SYSTEM TO PLAN AND CONTROL A STORES OPERATION

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The University of Illinois, the University of Michigan and National Software Enterprises, Inc. are involved in a joint venture to develop an application software package that addresses the stores operation. This paper discusses the background and the resulting University Stores System that is being jointly developed by the above three institutions.

. BACKGROUND

The current relationship between colleges/universities and software vendors as they relate to cooperative development of application software are of four general types. Namely, the installed user product, the joint development, the modular enhancement and the adaptation or conversion. Some examples of these relationships are the DUKE/IBM Hospital Online Order Communication System, the Indiana University I/A Financial Aid System and the University of Illinois/Technicon Online Hospital Order Communication and Reporting System.

While these are good cooperative ventures between institutions and software vendors, usually only two parties (one institution and one vendor) are involved and share the limited benefits. Why not involve more institutions? The University of Illinois Alumni/Foundation Online Information System cost over a million dollars and four years to complete. If others were involved in the development of the Illinois Alumni/Foundation System, the development cost (per institution) and time could have been reduced.

During the past year, the University of Illinois has been promoting the multi-institutional vendor development venture concept. The concept is one in which the institutions and vendors share the application development cost and in the cost recovery from future software sales. Such a venture has been consummated between the University of Illinois, the University of Michigan and National Software Enterprises, Inc. in the "shared development" of the University Stores System.

The venture was conceived at the 1980 CAUSE Conference and the Big Ten 1980 Materials Managers meeting. After several months of discussion and negotiations among the University of Illinois, the University of Michigan and National Software Enterprises, Inc., the University Stores joint venture commenced in July, 1981. Upon completion in 1982, both Universities will have a fully operational system in a shorter period and at less cost than otherwise possible.

INTRODUCTION

The University Stores System is an application software package that addresses the stores (stockroom) business functions of a university. Functions specifically addressed include user department requisition processing, requisition picking and shipping, inventory planning and control, purchasing and receiving, catalog printing, gas cylinder demurrage, equipment pool rental processing, and billing and accounting interfaces.

Within these areas, stores management is usually faced with a multitude of related problems. Some of the more frequently discussed stores problems are:

1. Tracking and processing of customer requisitions
2. What total inventory investment should exist to provide an acceptable level of customer service
3. Untimely access and updating of inventory records as a result of manual handling of paperwork for issues or receipts
4. Unauthorized issues or receipts adversely affecting the inventory accuracy
5. Poor control and coordination of multiple stores location
6. Handling the arrival of material with insufficient identification
7. Determining the exact status of a purchase order requisition
8. Determining the proper billing charges for requisitioned merchandise. rental equipment and gas cylinder demurrage

The University Stores System was specifically designed to address these common problems in addition to the numerous related problems that surface as a result of their existence.

SYSTEM OVERVIEW

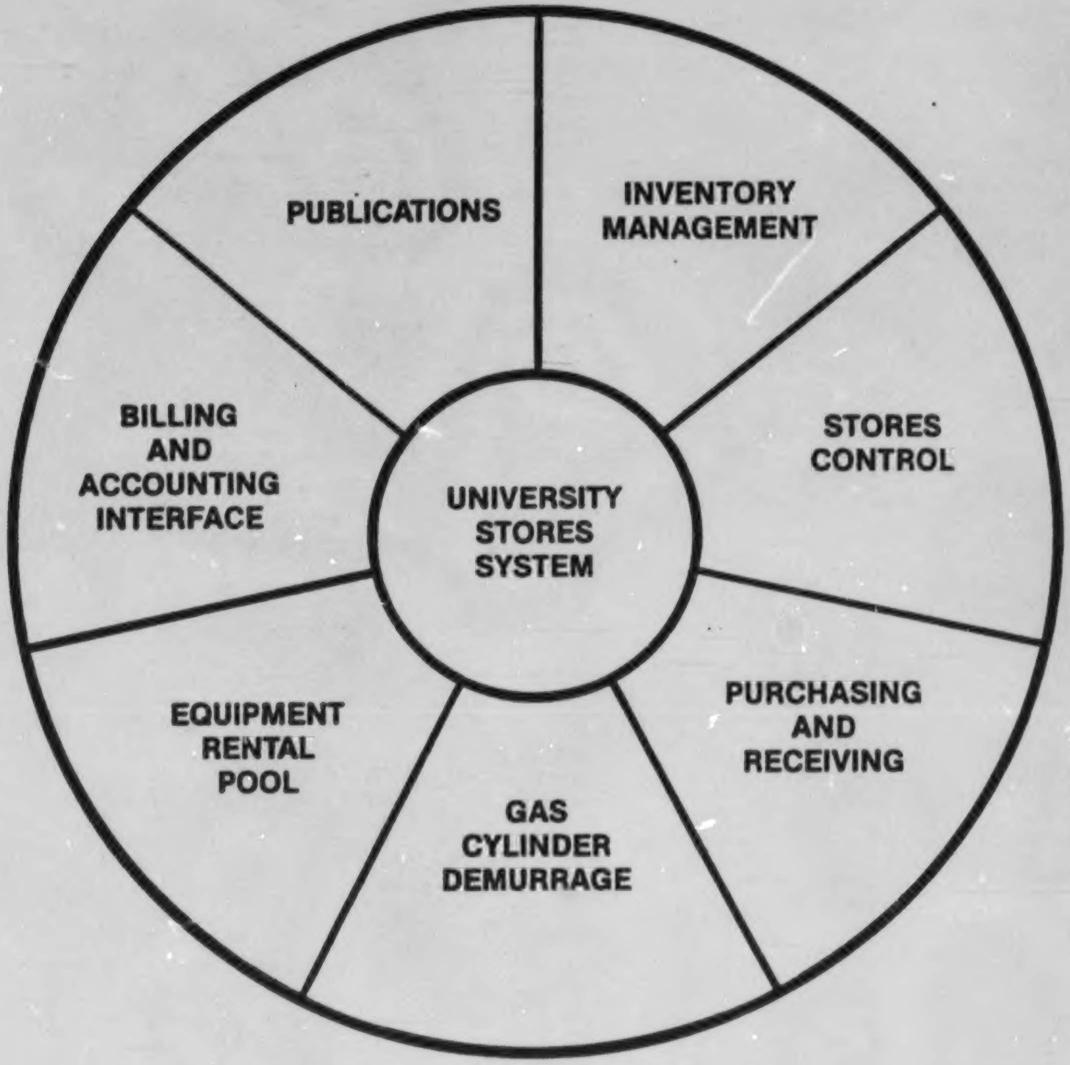
PUBLICATIONS
INVENTORY MANAGEMENT
BILLING AND ACCOUNTING INTERFACE
UNIVERSITY STORES SYSTEM
STORES CONTROL
EQUIPMENT RENTAL POOL
GAS CYLINDER DEMURRAGE
PURCHASING AND RECEIVING

Figure 1

FUNCTIONAL DESCRIPTION

The University Stores System consists of seven integrated subsystems (see Figure 1). As each subsystem addresses a specific function of a typical stores operation, the integration of all seven subsystems provides a comprehensive system for the management of the entire stores business function. A brief description of each of the seven subsystems follows:

1. Inventory Management

   This subsystem addresses the Forecasting, Inventory Planning and Inventory Control aspects of merchandising. A simulation process selects the best forecasting model from a series of moving average models. Based on the forecasted demand, inventory parameters (such as reorder points, order quantities, safety stocks and target inventory levels) are established. Online maintenance is provided to adjust any calculated parameter. ABC analysis is based not only on annual demand and unit cost, but as an optional feature, lead time and service level can be included. Replenishment analysis algorithms use the standard reorder point method, periodic review and on-demand reorder policies. Inventory control is responsible for the day-to-day transaction processing, cycle counting, exception reporting and transaction history features.

2. Stores Control

   The Stores Control Subsystem processes all customer requisitions. Requisitions are entered via online transactions, either directly by the customer or by stores personnel. Regular shipment, specials, walk-ins, cash sales and continuous requisitions are processed by the subsystem. Standard validation is performed on all data fields in addition to an audit against the Account Master Data base to verify the existence of a valid account number. Backorders can be created if insufficient inventory is available. Substitute items can be recommended to the user if desired.

2. Stores Control (Con't)

Picklists are generated in a batch and online environment to facilitate rush or emergency shipments. Backorders are also created at stock picking time. Upon entering the quantities issued via online terminals, billing records are created for customer invoicing. Complete audit trails and transaction history information is maintained on all customer requisitions.

3. Purchasing and Receiving

This subsystem is responsible for the generation and reporting of purchase order requisitions, confirmations, follow-up and receiving of purchased materials and invoice verification.

4. Gas Cylinder Demurrage

Integrated with Stores Control, Gas Cylinder Demurrage maintains the location of cylinders issued to user departments and generates the necessary demurrage billing information. Online inquiry is provided by cylinder number and account numbers to find cylinders issued to a specific customer.

5. Equipment Rental Pool

Similar to the Gas Cylinder Demurrage Subsystem, Equipment Rental Pool interfaces with the Store Control Subsystem to process rental equipment related transactions and generate the necessary rental billing information.

6. Billing and Accounting Interface

This subsystem captures all inventory related transactions and provides the necessary information to existing university accounting and financial systems.

7. Publication

This subsystem addresses the maintenance and printing of catalog, price and mailing lists.

The above seven subsystems provide stores management with the tools and capabilities to effectively manage the stores operation.

TECHNICAL DESCRIPTION

The University Stores System is being developed using a modular approach. Modularity allows for easier design, development and implementation.

Implementation and client customization is facilitated by the use of a Systems Parameter Table. This table will include such variables as standard report headings, frequency of reports, inventory parameters, accounting period lengths, forecast model selection criteria, and order quantity constants.

All programs will be written in COBOL utilizing structured programming techniques. The package is data base and data communications independent. The initial implementations are using IMS DB/DC.

The data security features (terminal and user identification) prevent unauthorized access and updating of sensitive or restricted data. Backup and recovery of information is also available. Complete transaction histories and audit trails are maintained for recovery and debugging activities.

Online interactive processing is employed on all file maintenance, requisition, purchase order and inventory transaction processing activities. Online inquiry and browsing are available to all data bases. Batch processing is used for the more routine reporting task where large amounts of computation and printing are required.

Improving Systems Development at Clemson University

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Clemson University has developed several application systems building blocks and procedures to assist in the construction and maintenance of administrative systems. These system components allow the administrative systems group to develop systems in a standard fashion and insure that the various applications have certain mechanics in common. Once staff members are trained in the use of these tools, they use them on all projects to which they are assigned, thus increasing the efficiency of all development projects. System maintenance also becomes less of an art, since most systems have similar components and employ standard techniques.

This paper addresses the techniques of using these system building blocks, including the following:

(1) On-line report request software
(2) On-line user table maintenance software
(3) Report Supervisor and report writer software
(4) Integrated data dictionary procedures and software
(5) Teleprocessing software
(6) Information retrieval software
(7) DBA procedures.

IMPROVING SYSTEMS DEVELOPMENT AT CLEMSON UNIVERSITY

INTRODUCTION

The Division of Administrative Programming Services at Clemson University is responsible for the design, implementation, and support of administrative application systems at the University. Over the last several years, the University has implemented several major information systems. To do this, it has been necessary to have the following three conditions. First, a desire on the part of the administration to achieve results in this area is mandatory. Second, an information systems plan that outlines major goals and milestones is required. Third, it is necessary to have an information systems group with appropriate resources and tools to achieve results. Although all of these conditions are necessary for successful results, the third factor will be discussed in this paper.

UNIVERSITY COMPUTER-RELATED ORGANIZATION

Not including academic departments, there are three departments on campus that have responsibilities in the computer field. The Computer Center is responsible for the hardware and systems software necessary to support academic programs and administrative systems. The Division of Information Systems Development contracts with other state agencies to perform systems development and support. The Division of Administrative Programming Services (DAPS) designs and implements administrative systems. After implementation, most of these systems are run in a production mode at the Computer Center by its Production Services group. All three computer departments report to Dr. Ed Byars, Executive Assistant to the President.

Although many departments on campus have computers of various types, administrative applications are run on the IBM 3033(U12) at the Computer Center. There is a large collection of hardware attached to the 3033, including 64 3350 discs, 16 tape drives, several IBM 6670 laser printers, and a computer output microfiche unit. Counting terminals on the campus as well as the state-wide network, there are approximately 700 CRT units attached to the IBM 3033. In the area of software, the University runs MVS, JES-2, TSO, IDMS DB/DC, SHADOW II teleprocessing monitor as well as most major languages and software packages.

The major areas supported by DAPS are the Business Office, Student Affairs, Academic Affairs, Alumni, and Development. Each of these areas has designated a

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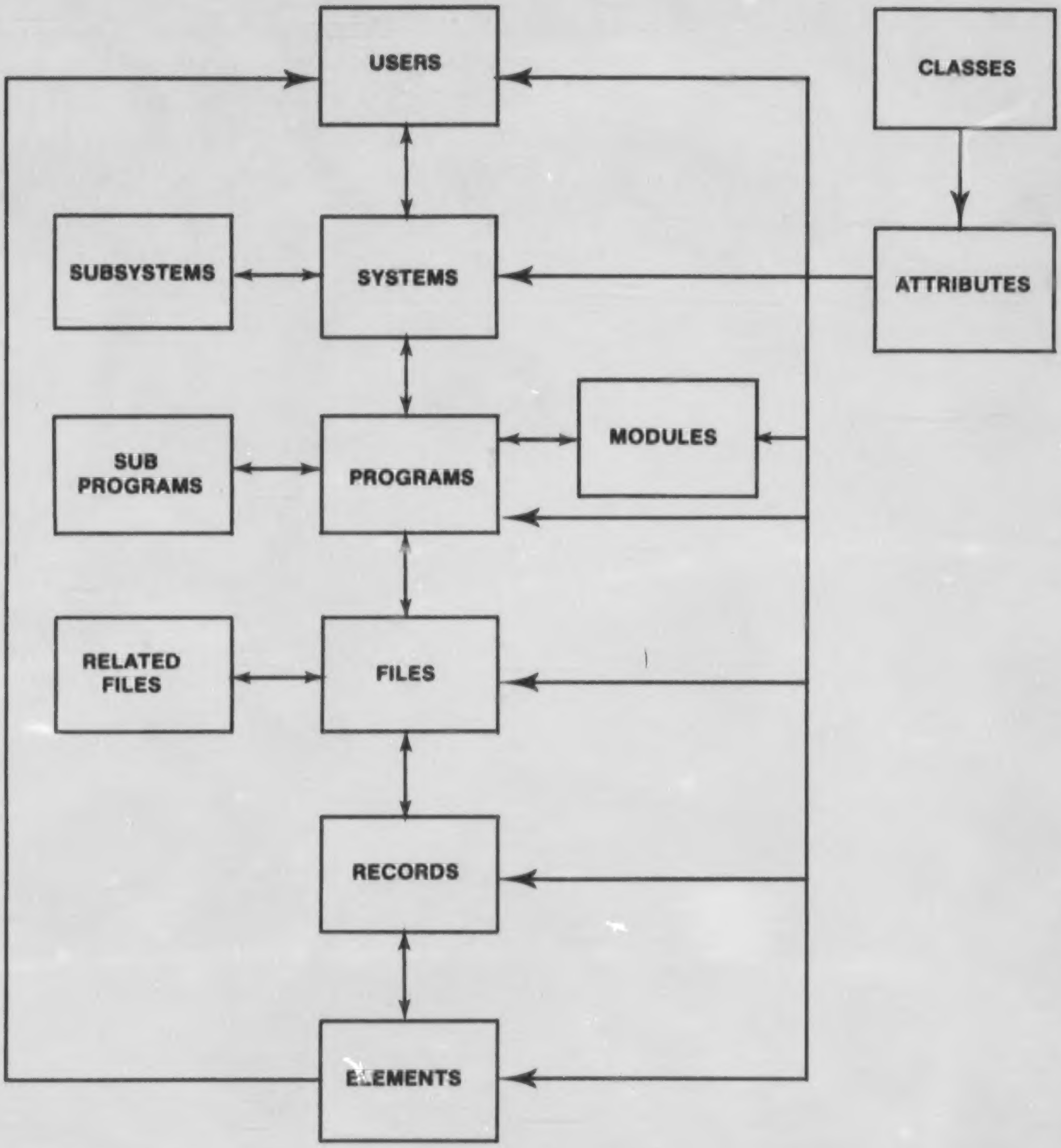
representative from its staff to work with DAPS in identifying appropriate information systems goals and in prioritizing related tasks. Among the groups, priorities are negotiated by the Director of Administrative Programming Services and the Executive Assistant to the President. An Information Systems Plan is developed and published in January that outlines in specific form the goals for the current year and in general form the goals for the two years after that year.

Within DAPS there are two teams dedicated to systems design, implementation and support. One team supports the Business Office and the other supports Academic and Student Affairs, Alumni, and Development. Each of these teams also performs necessary maintenance on the applications in its area. The Systems Coordinator develops and supports all procedures supporting the 'production' side of system operation, including documentation standards, tape and disc management, production libraries, and general technical support. The data base administrator assists in the development and support of systems by controlling the definition and operation of the University data base, as discussed later.

ENVIRONMENT AND PHILOSOPHY

Before reviewing the specific tools and techniques employed at Clemson, it is important that we review our systems development environment and philosophy. To date, all major application systems have been developed locally, although consultants in the general design area have been employed on several occasions. It is anticipated that, in certain cases, application systems will be purchased from vendors in the future, including the upcoming integrated library system.

All major applications are supported by an integrated data base, the design and implementation of which is directed by an applications-oriented data base administrator. An integrated data dictionary is used to keep a current inventory and description of data elements, systems, programs, users, records, and data bases. This dictionary also records the relationships between these entities, as shown in Figure 1. These relationships can be used to answer such questions as: How many different places is social security number recorded in university data? When was the last time the payroll compute program was loaded to production, and how many times has it changed this year? All data elements in the dictionary begin with a three-character identifier that indicates the type of data. These are shown in Figure 2.


USERS
CLASSES
SUBSYSTEMS
SYSTEMS
ATTRIBUTES
MODULES
SUB PROGRAMS
PROGRAMS
RELATED FILES
FILES
RECORDS
ELEMENTS

INTEGRATED DATA DICTIONARY ENTITIES AND RELATIONSHIPS

FIGURE 1

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DATA ELEMENT CLASSES

NAM	(Name)	Alphabetic data which identifies specific entities. (Example, Person's Name)
NUM	(Number)	Numeric or Alphanumeric data which identifies specific entities. (Example, Social Security Number)
CDE	(Code)	Data which identifies classifications of entities. (Example, Degree Code)
QTY	(Quantity)	The number or amount of anything (excluding dollars). (Example, Credit hours earned)
AMT	(Amount)	Quantity of monetary amounts
DTE	(Date)	Calendar Date.
DES	(Description)	Alphanumeric data which describes specific entities.
FLG	(Flag)	A one-byte code limited to two conditions.
PCT	(Percentage)	Values expressed as percentages.
CNT	(Count)	Total number of times to be expressed other than a quantity. (Example, CNT-OCCURS-DEP)
ADR	(Address)	Place where an individual or organization can be communicated with.
CON	(Conditions)	Values on 88 levels.

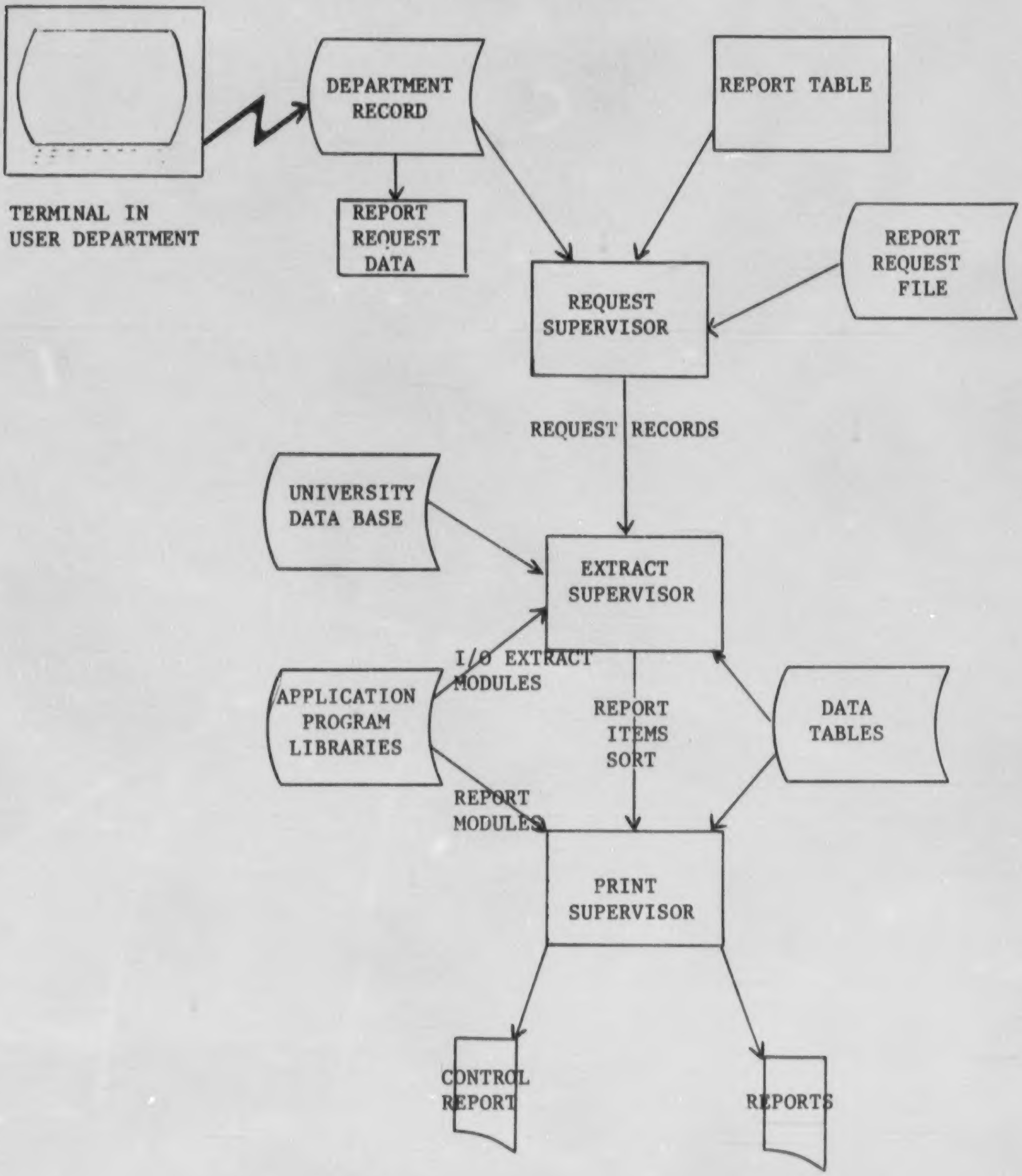
FIGURE 2

In developing systems, the project leader works closely with the DBA in determining data elements to be used in the system and relationships between these elements. All "new data" created by a system is reviewed against existing elements, to make certain that it is in fact "new." Also, potential records and record relationships are reviewed against current ones to determine if and how new records should be structured. When a system is implemented, a new physical data base may be created, but this should be an extension of the integrated University data base if we do our work correctly. The DBA also is responsible for the backup and recovery of data bases. IDMS Central Version software controls access to the data base and logs appropriate recovery and system activity information. Since IDMS handles most data base conflicts and short-term recovery automatically, the DBA becomes involved in recovery only if it is necessary to recover parts of the data base from a previous day, for example.

TOOLS AND TECHNIQUES

Given the systems development environment and philosophy, it is now appropriate to review certain tools and techniques used by all systems. Clemson chose to standardize as much as possible on techniques and system components so that analysts and programmers could become more productive in both the development and maintenance phases of projects. With the use of common tools and techniques, it is much easier for a programmer/analyst to support a project that he or she did not help develop.

The first tool is the on-line report request software, a supplement to the on-line retrieval and update commands available on most applications. This software allows a user in an administrative area to request certain reports from his or her terminal as well as to enter specific selection criteria and other report parameters. These reports are derived from portions of the data base to which the user has authority, and are usually reports that are needed on a non-routine basis. The reports can be requested and retrieved without the intervention of a programmer or even a production control person. A table of reports is maintained by the DBA that indicates the reports a given department has authority to request. These on-line requests and selection criteria are stored in a report request data base that is referenced by a nightly report job. After successful completion of this job, the reports are delivered to the customer and the report requests are deleted from the daily request list. Figure 3 is an overview of the report request system. The report request software is supported by on-line screens


TERMINAL IN USER DEPARTMENT
DEPARTMENT RECORD
REPORT REQUEST DATA
REPORT TABLE
REPORT REQUEST FILE
REQUEST SUPERVISOR
REQUEST RECORDS
UNIVERSITY DATA BASE
EXTRACT SUPERVISOR
I/O EXTRACT MODULES
APPLICATION PROGRAM LIBRARIES
REPORT ITEMS SORT
DATA TABLES
REPORT MODULES
PRINT SUPERVISOR
CONTROL REPORT
REPORTS

REPORT REQUEST SOFTWARE OVERVIEW

FIGURE 3

that are formatted to remind a user of variable information that may be specified for reports. Using this software, for example, our Alumni department can quickly request on-line a report of all Clemson alumni in the Atlanta area who have given to the Alumni fund this year or conversely those who have never given to the Alumni fund. Not only is the report requested on-line, but the selection criteria are also entered and edited on-line.

Another tool available to users of administrative systems is an on-line table maintenance system. This software permits certain administrative areas to maintain important tables of data referenced by information systems. For example, student affairs maintains a table of valid majors and a table of all dormitory rooms. The Alumni office maintains a table of giving goals by geographic area. The tables are used to edit data values entered into on-line systems and are also used in production reports, since they contain descriptions as well as codes. In the past, such tables have been maintained either by programmers or by cumbersome batch systems. This software places the responsibility and authority for table data in the hands of the appropriate using department. Commands are available to add, delete, or modify table information using table-specific screen formats. Since information is entered directly into the tables data base, there is no lead time caused by routing updates through a programmer or production control person. Also, all data base recovery is handled by the Central Version data base software referenced earlier.

The third tool is a report software system designed to increase the efficiency of report runs and to make it easier to program and maintain reports. A data base is passed only one time when it is necessary to create a group of reports from it. Also it is not necessary for each report program to handle I/O operations and sort data into proper sequence. The software is composed of a request supervisor, and extract supervisor, and a print supervisor. The request supervisor receives all the requests to be processed for this run and converts these records to the form needed by the extract and print supervisors. These requests can come from the on-line report request data base discussed earlier or from other files. Each department to receive reports in a run is specified by using a DEPARTMENT control card. The extract supervisor calls I/O and extract modules to read the necessary records and to select the data to be processed by the print modules. Each extract module necessary for the reports requested has records passed to it by the extract supervisor, and the extract module determines if it is to select a specific record. The extract module supplies the user sort data, extract data length, and the extract criteria. The print supervisor calls print modules to produce reports from the sorted extract data. The print modules can request certain actions from the print supervisor, such as discontinue processing for this report request, return with a new extract record, write a control record, and return with the same record. To print lines of a report, the print module calls the print supervisor output module. The print supervisor also routes reports to the appropriate special forms, as indicated on the report request. An overview of the report software system is given in Figure 3.

The fourth tool used is a vendor-supplied integrated data dictionary (Cullinane's IDD) software package. As discussed earlier, the IDD serves as an inventory of data processing resources and also provides a cross reference of these resources. Most of the input to the IDD is captured automatically when programs or other software related items such as Job Control Language are placed into production libraries. Figure 4 shows information captured for each entity and indicates if it is captured automatically.

The fifth and last software tool to be noted is retrieval software for ad hoc on-line inquiries and reports. All accounting information for a given department or college is available to designated individuals through an on-line retrieval system. This information is usually retrieved from terminals located in the office of the dean or department head. These inquiries supplement the normal monthly budget status reports provided in most accounting systems. This software will soon be expanded to allow departments to encumber their funds in an on-line mode. End users can also retrieve information from data bases using the CULPRIT language or the SAS package. CULPRIT is used to retrieve information from IDMS data bases and SAS is used to create reports from standard data files.

In addition to the special tools used at Clemson, it is also useful to discuss the techniques used in on-line system development. The importance of data base design has already been discussed. However, it is also critical that on-line systems be composed of commands that are easy to use, leave an appropriate audit trail, and are reasonably easy to program and maintain. All on-line programs follow a standard format and conventions. Clemson has developed a generalized edit software package that can reference tables such as those maintained by the on-line table software discussed earlier. Thus, individual programs can reference this generalized edit software when it is necessary to

INFORMATION IN THE INTEGRATED DATA DICTIONARY

Programs

- Program Name *
- Language *
- Language Version *
- Compile Options *
- Link Options *
- Comments *
- Date Compiled *
- Version *

Records

- Data Elements in Record
- Version/Date

Data Elements

- Definition
- Prepared by
- Description
- Data Type
- Records where used *

Systems

- Description
- Project Leader/Backup
- Programs in System

Files

- Physical data base areas *
- Schemas used in *
- Programs accessing file *
- Records *

Job Control Language

- Job Name
- Job Parameters *
- Programs & Procedures Executed *
- Comments-Documentation *
- Rerun Instruction *
- Data Sets Referenced *
- Number of Tape Drives *

Composite Linked Modules

- Program Name
- Language Version
- Link Options *
- Programs included in module *

* Indicates information captured by production load software

FIGURE 4

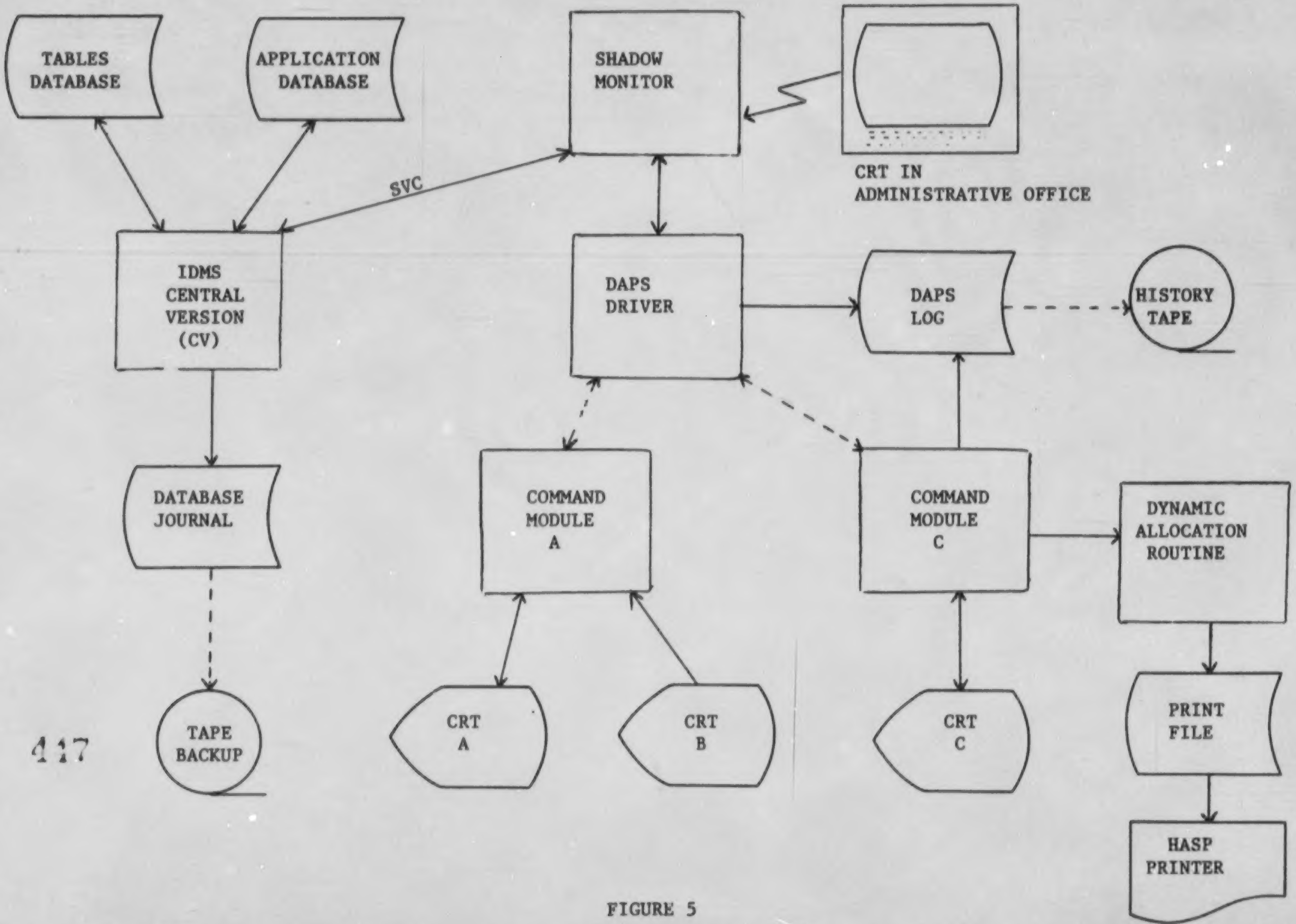
edit or decode a data element. Not only are tables stored in a central library and maintained by the customer, but also it is not necessary for each programmer to become familiar with each table format and write code to reference the table.

Each on-line program module also logs changes in sensitive data to a shared log file, which is used if necessary, to determine who updated certain information and when they did it. The log file is also used to print transaction logs of data batches entered on-line, such as batches of gifts to the Alumni fund. To insure that no on-line programs violate department standards or are inefficient, an on-line program must pass a review of an internal technical committee before it can be placed in a production environment. Disapproval by this group can result in the system implementation being delayed or parts of the system being reprogrammed. Figure 5 gives an overview of the components of administrative on-line systems.

CONCLUSION AND PLANS

There are many productivity aids being marketed which promise to reduce drastically the drudgery of systems development. These aids are usually linked closely with a particular data base management system and teleprocessing monitor. The next generation of productivity aids used at Clemson will most likely be totally vendor-supplied software rather than locally written extensions to vendor software as we have now. Immediate plans call for the improvement of those aids which most directly impact our users, i.e., the on-line information and ad hoc report retrieval aids we are now using. We are beginning to evaluate some of the application development tools now available and will procure one if it demonstrates potential for improving our environment still further.

ON-LINE SYSTEMS STRUCTURE



TABLES DATABASE
APPLICATION DATABASE
SHADOW MONITOR
CRT IN ADMINISTRATIVE OFFICE
SVC
IDMS CENTRAL VERSION (CV)
DAPS DRIVER
DAPS LOG
HISTORY TAPE
DATABASE JOURNAL
COMMAND MODULE A
COMMAND MODULE C
DYNAMIC ALLOCATION ROUTINE
TAPE BACKUP
CRT A
CRT B
CRT C
PRINT FILE
HASP PRINTER

417

418

FIGURE 5

COURSE OFFERINGS - NOT JUST A REGISTRATION NECESSITY BUT A UNIVERSITY OF GEORGIA RESOURCE

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The University of Georgia's Course Offerings System became operational in July 1980 in readiness for the implementation of a new on-line registration system. All section data are entered and maintained on-line; every element is immediately validated against the course, faculty and facilities data bases or tables, to ensure consistency. Special registration requirements, such as editing controls and the production of special forms are established at time of entry within each section.

During the execution of the on-line registration program the available seats, enrollment and credit hour totals are maintained, and 'logically shared' student segments are inserted tying students to the sections for which they have successfully registered.

Once registration is complete the data base is an on-going data collection point for several user offices, and is the source for student schedule reporting, space utilization, budget (credit hour) reporting, curriculum reporting and historical analysis.

Introduction

The University of Georgia, chartered in 1785, is the oldest state chartered University in America. Located in Athens, 75 miles northeast of Atlanta, The University has an enrollment of 23,800 in its day class division, 700 in its evening division and 850 in its off-campus academic programs. The University offers degree programs at batchelors, masters and doctoral level through 13 schools and colleges including the Law School, The College of Veterinary Medicine and The Graduate School.

The Office of Administrative Data Processing provides computer-based information system services to the administrative departments of the University of Georgia. These services are provided through four departments: Student Applications, Business Applications, Technical Support and Control and Data Entry. The Student Applications department consists of 1 manager, 5 designer/analysts and 8 programmers.

The University operates 2 IBM 370/158's, each with 8 megabytes of memory. One machine is dedicated to Administrative Data Processing; the other is used for research and instruction. System development software includes IMS DB/DC data base management system, IBM's Application Development Facility (ADF) and Batch Terminal Simulator (BTS), and Informatics MARK IV.

The Registrar's Office completed a Conceptual Design Document in May 1979 outlining their goals, requirements, and method of input for a new on-line in person registration system. Administrative Data Processing became involved in June 1979 to develop a detailed design which was completed the following December. OpSTAR (Optical Scanning Terminal Assisted Registration) was targeted for implementation in October 1980, for Winter quarter 1981 pre-registration. Although never discussed in detail, the implications of developing an on-line imperson Registration System necessitated the creation of a schedule of classes with which the on-line registration could interact.

Course Offerings System Objectives

- Be operational by July 1980 to create the winter 1981 schedule of classes.

- Synthesize the requisite faculty, course, and facility information to drive registration.

- Be able to input and update many quarters' schedule of classes at any time for various curricular program codes eg. Day School, Evening Division, In-Service.

- Ensure data validity at time of entry by utilizing existing data base systems to dynamically edit data.

- Establish editing controls for registration at time of entry eg. Departmental or School restrictions, Lecture/Lab requirements, etc.

- Be able to input and maintain enrollment and credit hours in split level and cross listed courses.

- Serve as an on-going data collection point for various offices on campus and for other computer systems.

Course Offerings Data Base System Concept

The Course Offerings data base consists of six segments; Course Offerings Section data below which reside, Access List, Students, Meeting Place, Instructor, and underneath the Instructor the Paying Department Segment. A secondary index allows browsing by term offered and course identification. The student segment is logically linked to the Student Registration data base.

The creation and maintenance of course offerings data is almost wholly performed on-line via cathode ray terminals (CRT). IBM's Application Development Facility (ADF) was used to program this system, which at time of implementation consisted of 11 update screens, and 8 browsing screens. To accomplish the necessary editing of Course Offerings data the ADF transactions interact with six other data bases and numerous MARK IV tables. This allows immediate feedback to the terminal operator of invalid or inconsistant data and insures that the data base is only updated once all editing criteria have been satisfied. Three further transactions have since been added; one to facilitate the immediate printing of special forms used by registration; another to effect the complete creation of section, meeting place and instructor data via a single screen; and a third to enhance the creation of course comments for publication.

The creation and maintenance of Course Offering data is an ongoing process, however three functional areas will be discussed in detail.

Creation of the Schedule of Classes

The schedule of classes is prepared by the Registrar's Office from section request forms submitted by academic departments. These forms identify the necessary course, enrollment controls, room and instructor assignments. Approximately 5000 sections are input for each quarter except summer which averages 3000 sections. The complete on-line loading process takes 2 clerical personnel 13 days.

The Course Offering root segment contains section data and is accessed via term offered and a five position call number. The call number is generated at load time by accessing the system controller data base to retrieve the next sequence number; a check digit is calculated and assigned to the first position of the call number (see Figure 1). When adding a section the Course Inventory Data Base is interogated to ensure that the course exists and can be offered for the term and curricular program requested. Once validated the course title, credit hour information, type of instruction, hegis code, and teaching department are mapped back to the Course Offerings Data Base. The number of special forms such as Permission of Department (POD), Permission of School (POS), Permission of Honors (POH) and schedule adjustment forms, are calculated.

COURSE OFFERINGS

DATA BASE RELATIONSHIPS

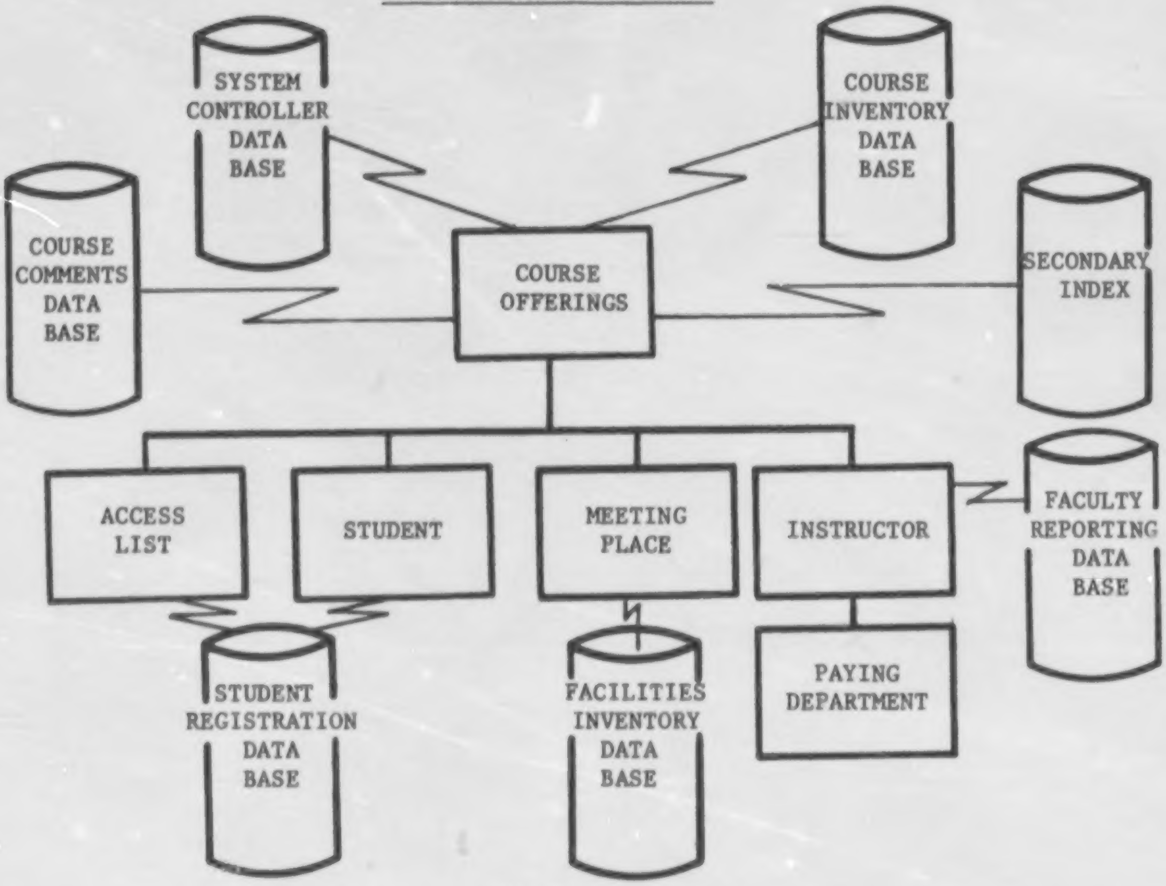
SYSTEM CONTROLLER DATA BASE
COURSE INVENTORY DATA BASE
COURSE COMMENTS DATA BASE
COURSE OFFERINGS
SECONDARY INDEX
ACCESS LIST
STUDENT
MEETING PLACE
INSTRUCTOR
FACULTY REPORTING DATA BASE
STUDENT REGISTRATION DATA BASE
FACILITIES INVENTORY DATA BASE
PAYING DEPARTMENT

FIGURE 1

If room assignment information is available a meeting place segment is created for each period the class meets. The building and room are verified against the facilities inventory data base and room accessability is mapped to Course Offerings. A class usage segment is inserted below the room indicating the times the section meets, and all meeting place changes are applied to the corresponding class usage segment. If a room is not found on the facilities inventory data base, the terminal operator can immediately switch to the Facilities Inventory ADF system and browse rooms within the building. This often reveals that a simple typographical error occurred when preparing the section request form.

Instructors social security numbers, if provided, are edited against the Faculty data base and the surname mapped to the Instructor segment. If the social security number is not found, the terminal operator can switch to the Faculty Reporting ADF system and browse using the name supplied on the section request form. Transposition of the social security number is a common error and can be corrected immediately.

Course Comments which appear in the printed schedule of classes can be positioned above and below a particular section, course identification, range of course numbers or discipline.

Once the sections have been created for a quarter a proof list is sent to departments for validation, update and input of missing data. Section maintenance completed, the OpSTAR Schedule of Classes goes to press. and the printed booklet is produced. Course Authorization forms are printed in batch mode in preparation for Phase I registration (pre-registration), and sent to the academic departments for distribution.

OpSTAR Interface

An Open Section List is prepared and posted daily in the sectioning area, to inform the students of available courses. The students complete a Registration request form using the five position call number to identify the sections desired, whether they want to register for, drop or audit classes, and designate variable hour credit hours. The student then delivers this, plus any special forms, to the data entry station where it is read by an optical scanning device.

Course enrollment override or special permission forms cause the creation of an access list segment within the section specified. Students on the access list are guaranteed a seat in the class.

The Course Offerings data base is accessed using the call number coded by the student, once the student is deemed eligible and free of registration holds. Course availability is determined by reviewing Course Status (active, closed, or cancelled), number of seats remaining, class restrictions (which may also require an access list segment), variable credit hour information if applicable and whether duplication of the course is permissable.

If all of the edits are satisfied the student is then enrolled in the class by inserting a student segment within the section. The number of seats assigned and total credit hours are updated, and the section marked as 'CLOSED' if the last seat was taken. Notification of section closure is printed so that the open section list can be immediately updated.

If the registration attempt was not wholly successful the student receives a problem schedule, notifying him or her of the reasons why their section requests could not be completed. If the registration process was successful the student receives a Fee Statement, which is a three part form consisting of The Schedule, giving time and location of each class; the Fee Invoice, itemizing fees assessed; and the Fee Receipt, to verify payment. The registration process is now complete.

At the close of each registration day the Course Offerings data base is immediately available for section reporting. Daily enrollment statistics are made available to the academic departments to aid them in anticipating student scheduling needs. The creation of new sections, and maintenance, increasing maximum enrollment for example, take effect immediately.

Prior to Phase II registration (Late Registration), students who have not paid fees have their schedules cancelled. The cancelled seats are re-instated, and any seats requiring special permission generate replacement Course Authorization forms which are returned to the department. Schedule Adjustment forms are printed and distributed to the departments in preparation for Phase III registration (Drop/Add).

Curriculum Reporting

Approximately two weeks before late registration, the Office of Institutional Research and Planning (IRP) distributes a Course Offerings Turn-around Document to the academic departments. This document identifies missing data for the departments to correct and is returned for update via CRT. A list of sections whose instructors do not teach all of the students enrolled (e.g. graduate thesis) is also distributed and the departments note which instructor is teaching which student(s). This 'tie' is entered into the Course Offerings data base to ensure that the credit hours and enrollment generated by instructors is reflected accurately. A similar mailing is also prepared on the first day of classes.

About three weeks into the quarter, when the bulk of schedule maintenance and section update has been completed, the enrollment and credit hour information within the Course Offerings is 'frozen'. At 'Freeze-time' the current enrollment and credit hour totals in the root segment are mapped to frozen fields. The instructor enrollment and credit hours is calculated depending on instructor type (e.g. are the students taught as a class or individually) and the instructor's percentage teaching responsibility. A paying department segment is created, containing credit hours, the paying departments percentage responsibility and the method of input. The teaching department is designated the paying department unless an override has been specified. Finally the instructor's payroll department is matched to the teaching department, and the resulting non-matches reported to the Budget Offices for review. Sections are then edited to ensure that the summed instructor hours, paying department hours and frozen section hours all balance. Once the credit hours balance and all of the paying department changes from the Budget Office are completed, the updating cycle of the Course Offerings Data Base is finished.

Non-regular university courses are added to the Course Offerings Data Base from enrollment reports submitted to the Registrar's Office. Evening classes, correspondence, center and extension, in-service and regents study abroad classes do not have student segments, current enrollment or credit hour totals; but in all other respects the editing criteria for section creation, maintenance and reporting is identical.

Summary

The Course Offerings on-line system was implemented in under three months using IMS data base techniques, Application Development Facility (ADF), Batch Terminal Simulator (BTS) and Informatics MARK IV; by two programmers with limited data base experience and one analyst. One of the major factors in achieving the system objectives previously identified, was the IMS-ADF and MARK IV development approach utilized. The productivity gains by using ADF over the traditional IMS COBOL or PL/I approach has been estimated from 1-14 to 1-28[1]. The MARK IV programming language has a virtually transparent interface to IMS data bases which speeded up the load process by about five-to-one. Last but not least the use of BTS to simulate an IMS on-line environment via TSO, cut testing time by approximately 60%.

A word of caution: do not be mislead by thinking that ADF can do it all for you! ADF allows you to program the commonplace with ease, but the more complex transactions require creativity, an understanding of IMS/DLI and persistance on the part of the programmer. We are indeed fortunate that the data processing personnel involved had all of these qualities plus the imagination and effort to succeed.

The Registrar's Office and the Office of Institutional Research and Planning undertook their new responsibilities with enthusiasm, and their commitment to the Course Offerings Data Base concept cannot be understated. Duplication of effort has been eliminated by sharing information and the timeliness and accuracy of the data has improved. So it is the combination of people and technology that made Course Offerings not just a Registration necessity but a University of Georgia resource.

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[1] J. Reid Christenberry, Application Generators for Administrative Data Processing: The University of Georgia's Success with IMS-ADF and MARK IV, (Salt Lake City, Utah: 25th Annual College and University Machines Records Conference, 1980).

TRACK VI
PROFESSIONAL TECHNIQUES

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APPLICATIONS DEVELOPMENT
A WHOLISTIC APPROACH

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Wholistic (holistic) medicine is a growing humanistic philosophy based on the premise that mind and body cannot be separated when addressing health. Applying this philosophy to applications development, the mind and body of a system, analysis and programming must be seen as one continuing process rather than two disjunctive events. This philosophy would imply a more humanistic approach to all participants in the process, recognizing their individual contribution to the whole.

In 1979 LSU assumed a new posture and implemented Applications Development Standards to address the entire development process in a basically wholistic manner. These standards differ from most in that:

1) They provide a step by step guideline to the entire application process from initiation to implementation to maintenance.
2) Instead of listing rules, they list required deliverables, making documentation a by-product rather than an afterthought.
3) They allow the programmer and analyst the flexibility to exercise his/her technical expertise to do the job most effectively.

This paper will review the two year history of these wholistic standards from both the user and DP standards. Where do these standards fail? Where do they succeed? And is the approach viable in the real world?

APPLICATIONS DEVELOPMENT: A WHOLISTIC APPROACH

There is an interesting parallel between problems in computer application systems and disease or malfunction in a human body. Both situations vary in impact from minor to potentially fatal. Both require varying degrees of attention and can be treated either with regard to symptom or cause. Both will usually worsen if ignored entirely and will be harter to treat the longer they are left unattended.

In the area of health and medicine a new approach is catching on called wholistic (holistic) health. The supporters of this philisophy advocate a new perspective on health centered on a view of mind and body as inseparable in treating and preventing disease. In wholistic medicine the major emphasis is on eliminating the mental and physical processes which encourage or cause ill health. This philosophy also places most of the power and responsibility for good health in the hands of the patient, not the doctor. Maybe a little holistic medicine could help to heal some of the ills of computer programming applications.

CHANGES AT LSU

In the mid-70's LSU in Baton Rouge was operating two computer centers, one academic, one administrative. The academic center did not have the machine power to adequately support the research needs of the university. The administrative center had neither adequate staff nor equipment to provide up-to-date administrative systems and was essentially maintenance-bound. The Louisiana State Legislature decided to address these problems by funding the purchase of a "supercomputer" with the stipulation that the two centers must merge. This decision brought about an overwhelming quantity of change which essentially threw LSU-BR computing into a state of future shock. Within a period of one to one and a half years the following changes were made:

1. The merger of the academic and administrative computer centers.
2. Replacement of an IBM 360/40 and IBM 360/65 with an IBM 3033 (the first in a university).
3. Conversion from DOS to OS of the administrative center.
4. Doubling of the size of the administrative staff.
5. Revamping of development philosophy to a data base concept.

6. Training of old and new staff in data base philosophy.
7. Layout plan to replace all administrative systems.

Needless to say, it was extremely difficult to maintain an equilibrium, much less to develop workable applications systems in the face of such change.

The primary need for viable standards was apparent, but it was also apparent that most programming standards won't stay viable for long. With the assistance of Gerry West of IBM, five computer center staff members were sequestered for several days to address the problem. Recognizing that we faced an extremely difficult taks, out first step was to review the "illnesses" created by our existing development methodology.

Many of the problems seemed to arise from the practice of treating symptoms and not investigating cause. When a user came in with a problem, the common solution was to write a prescription (program) and tell them they'd feel better in a week to ten days. More time was needed working with the user to determine the real basis of need. Obviously, this also requires a great deal more effort on the part of the user.

Another problem was that analysis and programming were considered separate functions with a distinct dividing line between them. But if programming is the body of a system, analysis must be the mind. In a truly wholistic approach one can only see these as two phases of one unified process. In medicine there is an increased awareness that seemingly completely "physical" diseases such as cancer and even arthritis are so heavily influenced by anxiety and stress that those mental problems may actually be casual. Support for this reasoning is even more apparent in the link between analysis and programming. No really successful system can be developed on the basis of a poor design. Standards should address nor only the programming funtion, but the entire development process from start to finish.

In previous development practices the relationship of the user to analyst or programmer/user was like that of the patient to the doctor. The patient has a problem which the doctor says magic words over, being sure to never let the patient see that words are not really magic. Although the user is often reluctant to take increased responsibility for the health of his own systems, healthy systems cannot be developed without the involvement and understanding of the user. Good applications development standards have to provide for some method of communication between user and DP whereby each can fully understand what is being agreed upon. This is not possible if the analyst or programmer insists on speaking in a jargon the user does not understand. Nor is it possible when the user sees the DPer as totally responsible for bringing up an application system.

In addition to these philosophical problems we identified some concerns with the specifics of any standards. Do they provide the programmer with a creative tool or a stifling burden? If standards are a list of rules, how do you cover all stituations? How can you tell when you've done what you're supposed to? How do you keep them up to date?

By developing standards which take a more "wholistic" approach we hoped to resolve all these problems and more.

THE STANDARDS

The Applications Development Standards developed as a result of our investigation are structured around the five accepted phases of systems development. Each phase is subdivided into tasks and every task has a "deliverable" which serves to document the project and to verify whether the standards were correctly followed.

Each phase is followed by a sign-off meeting wherein users and DP review the progress and sign a document to indicate that they understand and agree with what has been done. Each phase serves as a foundation for building the next phase, so no processes can be skipped.

The first phase is the Required Definitions (RD). The objective of this phase is to provide a thorough statement of the users needs. The user, of course, is the principal participant in this phase. The tasks and deliverables in the RD are

1) Requirements Structure - The user and DP draw a block diagram showing the basic functions the user wishes to address.
2) Function Specifications - Each block (function) of the Requirement Structure is expanded into a more detailed function flow diagram showing input and output.
3) Information Set Description - Each input/output referred to in the Function Specifications is described.
4) System Interface - A brief narrative is written describing the necessary interfaces between this project and other systems.

As indicated, these tasks are sequential and build from phase to phase. When completed, the project leader circulates the RD documentation and obtains approval signatures from designated DP and user representatives involved in the project.

The External Design (ED) phase provides a general design of the Computer Center's proposed solution to the user's requirements. User involvement is still primary in the initial tasks of this phase. The phase includes:

1) User Information Set Designs - The user must identify and define all data elements necessary to meet his requirements and lay out screens, reports, and forms where this data will be collected and reported. These are based on the Information Set Description form RD.
2) Application Structure - DP draws a hierarchical block diagram showing what programs will be needed to accomplish the RD and to produce the output indicated in the User Information Set Design.
3) Demonstration Plan - DP draws up a plan of exactly how they will demonstrate the new system after its development.
4) Support Requirement - DP identifies what hardware and software will be required for the system, who is responsible for obtaining these, and how long it will take.
5) Evaluation of Available Application Packages - DP and users search for existing software that will meet the specified needs.

After the ED, another sign-off meeting is held. If suitable existing software is found the standards must be applied to the implementation of the obtained software.

The Internal Design (ID) phase is an extremely technical process wherein analysts and data base personnel are the principals. In this phase, the program specifications are written and the data base are designed. The tasks are:

1) Program Specifications/Stored Information Design - Analysts work with data base administration to suggest data base structure. Program Specifications are written.
2) System Run Materials - Analysts prepare flowcharts, JCL, run instructions, etc.
3) Demonstration materials/Program Test Materials - Analyst prepare the necessary data to properly test and demonstrate the system.

After completion of the ID, the Program Development (PD) phase can begin. Unlike the other phases, the tasks of this phase are performed once for each program. They include:

1) Program Design - The programmer devises a top-down program designed from the specifications provided in ID.
2) Logic Design - The programmer writes the program in pseudo-code.
3) Program Coding - The segments of the programs are coded.
4) Program Testing - The programmer tests the program.

Finally, the Demonstration and Installation (DI) phase addresses bringing the system into full production. The tasks are:

1) Preliminary Installation - DP transfers programs from test to production libraries.
2) System Demonstration - The Project Leader presents a formal demonstration of the system to the user. This demonstration was planned in the ED phase.
3) Installation - DP executes the initialisation procedures of the system.
4) Development Completion Interim - After implementation, the project is considered to be "in development" for a time designated in ED. This provides the user with time to verify the system and to request correction to unplanned short-comings.

The sign-off for this phase occurs after the interim time has elapsed. From that point forward the system is no longer in development and all changes are treated as maintenance.

ADMINISTRATION OF STANDARDS

These standards, like any others, cannot live without update, modification and review. To this end a Standards Committee is appointed by the Director of the Computer Center. The Committee is responsible for seeing that the standards are kept up-to-date. Persons wishing to modify the standards or to deviate from them for an exceptional reason may do so only after filing a formal request to the Committee.

The Supervisory Analyst in charge of each applications development area is responsible for seeing that all systems developed in his area are in compliance with standards. He also is responsible for seeing that persons under his supervision are trained in standards usage and provided with resolution of areas in question.

HOW SUCCESSFUL ARE THEY?

These application development standards were implemented in July 1979. Since then the computer center has completed Admissions, Purchasing, Alumni, Fee Bill Systems, and Traffic Fines/Vehicle Registration.

A System Personnel Information project and Treasurer's Office System are scheduled for implementation very soon. Other systems currently being developed using this methodology include Registered Student, Payroll/Personnel/Budget/Position Control, and Accounts Payable.

The Admissions System was the first application of the standards. If suffered most of the impact of the learning curve as well as the problems caused by the other changes taking place at LSUBR. Since that time both users and DP have become relatively accustomed to the standards. In interviews with representatives from both areas some disadvantages and advantages of the new methodology become apparent.

COMPLAINTS AND PRAISES

IT TAKES SO LONG. Users have complained loudly about how long it takes to develop a system under this procedure. However, these same users were accustomed to the "Take two of these, you'll feel better in a week to ten days" approach, so there was and is some adjustment necessary. Also, when asked which portion of the procedure should be removed to shorten the process, most users recognize each step as a necessary and valuable exercise. The most time-consuming portion is the User Information Set Design in External Design. In this task the user has to define each data element and lay out all reports, screens, and forms. Although most of the grousing arises during this step, most users readily accept the necessity of the tedium.

TOO MUCH PAPER WORK. There is a complaint about the volume of paper that comes from this method. Some of the paper produced has been identified as redundant and is recommended for deletion. This complaint has a counterpart praise in the fact that the amount of documentation minimizes ambiquity. Perhaps this is an area where one must choose an unpleasant method to obtain a highly desirable result.

THE USERS WANT TOO MUCH. This, of course, is not a complaint toward these standards, but a general widespread situation. These standards do not address a solution to this problem but do at least ascertain that the scope of the project is well defined. Some improvement may be possible in identifying how the scope could be narrowed.

THE USERS ARE NOT ALLOWED INPUT INTO THE STANDARDS. This is a very valid complaint. Since the users are an integral part of the methodology, their input is invaluable. The users are the principals in the first two phases and should be given more control over the process.

THE SCHEDULING AND TRACKING PROCEDURES ARE NOT ADEQUATE. Although the standards specify a projected schedule at the end of each phase, this task is not always accomplished. In addition, very little is done to compare target dates with actual completion dates after the fact.

IT IS HARD FOR THE USER TO FULLY UNDERSTAND AND MONITOR THE TECHNICAL PHASES. The Internal Design and Program Development phases are highly technical, yet the user is expected to agree and approve of materials he may not understand. Maybe great care is necessary here to make sure the terminology used facilitates user involvement. Also, maybe greater training is needed for the user liaison.

TOO FLEXIBLE/HARD TO MONITOR. The standards do not set down rules for exactly how each task should be accomplished, rather, they speficy what the task is and what deliverable is required as a result. This creates a situation where all programmers and analysts may not actually carry out the task in a uniform fashion. The disadvantage is that supervisory personnel must make a subjective judgement to ascertain that the methodology used is not a "bad" one. Reports are that this evaluation varies from supervisor to supervisor.

NO FEASIBILITY STUDY. The standards do not now include any cost benefits analysis or feasibility study.

THE STANDARDS HAVE NOT BEEN KEPT UP-TO-DATE. Although a standards committee was established, meetings are infrequent and, to date, no changes have been made.

It is reassuring to note that the majority of these complaints are not attacks on the philosophy of the standards. Philosophically the methodology seems to be a success. In praise of the procedure both users and DP have cited benefits primarily in the area of communication.

USER IS INVOLVED THROUGHOUT. Using this methodology there is no "passing of the baton" from user to DP. The user is an active participant in all phases of development.

RESPONSIBILITIES OF USER AND DP ARE DEFINED. The standards specify who is responsible for each task as well as who must review and approve the output.

SELF-DOCUMENTING. The deliverables required by standards provide complete documentation of the project and of the decisions made.

MINIMIZES MISUNDERSTANDING. Since both user and DP have to review and approve all phases, very little ambiguity is tolerated. Since the standards specifically indicate that DP terminology is to be avoided as much as possible, the user is not asked to learn a new vocabulary.

FLEXIBILITY. Programmers and analysts are allowed a degree of flexibility in carrying out their tasks rather than being required to abide by a rigid set of rules.

MINIMIZES MID-STREAM CHANGES. This results from two facets of these standards. First, the thoroughness with which the need and scope are determined help to reduce oversight. Secondly, the provisions for how to amend a completed phase provide documentation for exactly what will be required. Thus, when a change is encountered both user and DP have a better idea of the potential impact of the change.

SUMMARY RECOMMENDATIONS

The wholistic application development philosophy LSU adopted has proven to be a sound one. The standards devised to reflect this philosophy have run through hills and valleys but are apparently worthy of continued use. Although problems exist, most of these could be reduced or remedied by a few modifications in the standards themselves or the administration of the standards.

Some suggested improvements include:

1) Involve the user more in the development of the standards. Have two or possibly three users on the Standards Committee.
2) Increase the activity of the Standards Committee. Have it meet at least quarterly. Change the standards in places where they apparently fail. If standards are not modified to keep up with the time and to respond to the needs of the users and DP, they will die.
3) Improve training for both users and DP in the philosophy and applications of standards.
4) Add a feasibility study or cost analysis procedure to the Requirements Development phase.
5) Move the search for application software packages either to precede

the External Design phase or to be done simultaneously with the first task of that phase.

6) Give greater control and responsibility to the user in the Requirements Definition and External Design phases.
7) Eliminate the Demonstrations Plan task from ED as it does not appear to be fruitful.
8) Beef up the scheduling, tracking, and projection procedures to provide better control over the project.

The primary requirement for continued success of these standards is an active Standards Committee. There appears to be solid management support for the standards themselves and the users are getting accustomed to and enjoying the involvement the standards require of them. But the standards will, as many do, become obsolete if left unattended. There are probably many detailed improvements which could and should be made to the standards other than those suggested above. By encouraging and responding to user and DP suggestions on improvements, the Standards Committee can ascertain that this sound methodology will be viable for years to come.

AUTOMATING THE CLERICAL CONTROL FUNCTION IN DATA PROCESSING

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As data processing systems evolve and become more sophisticated, increasingly higher demands are placed on control-function personnel to understand, submit, check and balance complex production systems and networks. A paradox has developed in many production shops, in that control personnel are needed during regular working hours to interface with external users, data entry personnel, etc., while the running of production work is done in off hours when control clerks are not present for detail balancing and verification. This results in the practice of submitting large numbers of jobs and "HOPING" everything balances in the morning. The failure of jobs to run properly can cause a significant rerun problem. This paper describes the techniques, operating philosophies and software in use at the University of Georgia that appreciably alter the "SUBMIT-HOPE-RERUN" type shop.

The system at the University of Georgia is known as Integrated Data Processing Control System (IDPCS). Instead of wading through hundreds of JCL listings each morning looking for problems, balancing totals, etc., this system allows for true "management-by-exception" by alerting appropriate personnel that problems have occurred, and giving them some indication as to the nature of the problems. IDPCS is NOT just a condition code checker; it actually validates that a job ran correctly by checking totals, validating that datasets were catalogued, etc., as a control clerk would do.

IDPCS requires NO changes to application programs. IDPCS can validate any job step including sorts and other utilities. IDPCS is NOT a scheduling system but can be used to augment a scheduling system if one is installed.

AUTOMATING THE CLERICAL CONTROL FUNCTION IN DATA PROCESSING

Introduction to The University of Georgia

The University of Georgia is the oldest state chartered university in America. Chartered in 1785, The University is located in Athens 70 miles east of the capitol city, Atlanta. In Fall Quarter 1981, the enrollment was approximately 25,000 students in 13 schools and colleges.

Office of Administrative Data Processing

The Office of Administrative Data Processing provides computer-based information system services to the administrative departments of the University of Georgia. This service primarily involves: maintenance of currently existing user data processing systems, modification and expansion of current systems, assisting and/or training user departments in obtaining various ad hoc reports, development of "state of the art" user-oriented application systems, and provision of data entry and control services for administrative users. These services are provided through three departments: Student Applications, Business Applications, and Control and Data Entry.

Background

As data processing systems evolve and become more sophicated, increasingly higher demands are placed on the control function personnel to understand, submit, check and balance complex production systems and networks. A paradox has developed in many production shops, in that control personnel are needed during regular working hours to interface with external users, data entry personnel, etc. while the running of production work is done in off hours when control clerks are not present for detail balancing and verification. This results in the practice of submitting large numbers of jobs and "HOPING" everything balances in the morning. The failure of jobs to run properly can cause a significant rerun problem. This paper describes techniques, operating philosophies, and software in use at the University of Georgia that can appreciably alter the "SUBMIT - HOPE - RERUN" type shop. The system at the University of Georgia is known as the Intergrated Data Processing Control System (IDPCS). Instead of wading through hundreds of JCL listings each morning looking for problems, balancing totals, etc., this system allows for true "management-by-exception" by alerting appropriate personnel that problems have occurred, and giving them some indication as to the nature of the problems. IDPCS is NOT just a condition code checker; it actually validates that a job ran correctly by checking totals, validating that datasets were cataloged, etc. as a control clerk would do.

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Control Functions

In production data processing installations, the control department must be concerned with checking, balancing and validating of job outputs to assure that all jobs have run correctly and in the proper sequence. The control department should also have some historical record of what was run, when it was run, and what the results were. When a problem does arise, the control department is expected to produce an audit trail of JCL listings of jobs involved with the problem. IDPCS is a production environment, control support utility that can assist with or totally alleviate the control personnel of these duties.

Integrated Data Processing Control System

IDPCS is heavily oriented toward TSO and uses TSO extensively in the background mode. 5740-XT6, IBM's TSO Background Command Package which is an extension of TSO, is required by IDPCS. The IDPCS user is assumed to use TSO as the main "tool" for creating and maintaining the datasets (libraries) used by IDPCS. IDPCS is divided into three major facilities that perform clerical control type activities. The three facilities are the Job Post Processor Facility, Log-Trace Facility, and Output Stacking Facility. These three facilities may be implemented independently of one another, but are designed to work as a unit.

JOB POST PROCESSOR FACILITY

This facility is the "heart" of IDPCS. It provides for the moving of job output from the OS spool to a user dataset, then performs checking and validation of the job. The Job Validation Function is implemented at the JCL LEVEL. NO CHANGES ARE REQUIRED OF ANY SOURCE PROGRAMS. The Function is totally language independent and usable on ANY type program including sorts and other utilities. This means that any job or job step that can be validated by a control clerk can be validated by JPP. The Job Validation Function provides for :

1. The checking and balancing of any type job
2. The storage and retrieval of balancing totals and other pertinent information
3. The notification of multiple TSO users of a jobs completion status
4. Provides for job submission based on prior job results

JPP Concept:

It is TSO's ability to route output from jobs back to a terminal that makes JPP function. Jobs do NOT have to be submitted via the TSO terminal for this output option to work. To "trap" job output in a TSO hold status requires a simple change of the output class in the SYSOUT DD cards and the

MSGCLASS in the JOB card. By using TSO in the background (batch) and issuing the OUTPUT command with the "PRINT TO DATASET" option, "OUTPUT jobname(JOBjob#) PR('dataset')", batch job printer output can be placed in a data file. Only the job output needed for job validation is "trapped" and placed in the data file. Other outputs, such as large reports, can be held until after job validation and then be released by JPP. For many jobs, the JCL Messages may be all that is needed for job validation. After the job output is in the data file, a program can check this file for the "key" elements that constitute the valid running of a job (i.e. cond. code values, datasets cataloged or deleted, etc.). Totals that were stored by earlier jobs (such as sort or master file totals) can also be checked. It is important to emphasize that all of this has been made available by changing only the output class in the current JCL and "attaching" a JPP Job to do the checking and validating. The overhead of having an additional job (the JPP job) following each key production job is minimal. Most will take less than one minute of REAL time and will be running in off hours when most shops have a few minutes to spare. JPP requires a SCRIPT (PDS member) for every production job it validates and a STORAGE (PDS member) for each total or data component to be used and/or saved. These PDS libraries are minimal in nature also.

SCRIPTS:

JPP uses a very simple script technique to validate jobs. These scripts are 80 byte records and are stored as members of a

PDS. This allows for the use of TSO editors as the service "tool" for scripts. The scripts contain only information to be looked for and are checked against the "trapped" job output, line by line. In many cases the "trapped" output needed for validation may only be the JCL listing. In the script, you provide the location (print position) in the line and the length to be checked along with a literal to be checked for and an operator to be used.

EXAMPLE:

```
         1         2         3         4
1234567890123456789012345578901234567890
  05109=COND CODE
```

This script record says look in print position 51 for a length of 9 for the words COND CODE. After this is located, a second script record would probably follow that would check the actual cond. code value. It might look something like this:

EXAMPLE:

```
         1         2         3         4
1234567890123456789012345678901234567890
C 06104<0008
```

This script record says Continuing on the same print line("C") where COND CODE was found, look in print position 61 - 64 for a value less than 0008.

These examples are basically how all scripts are written. A script is just a collection of continued and non-continued script records in the sequence that they appear in the "trapped" output. Each script record must be satified before the next script record will be considered. Note that the continuation technique is different than in most other utilities. The continuation "mark" (a non-blank character in column 1) is placed on the continued script record. You may have as many continued script records following a non-continued script record as you need. All script comparisons are made as characters unless the "numeric option" or the "accumulator option" is invoked.

LOG-TRACE FACILITY

The Log-Trace Facility implementation will depend on how it is utilized by the user and/or installation. The following discussion assumes that the Job Validation Function is being used. The reader should note that the same batch TSO step used to submit JPP could be used to do just the log-trace functions. The Job Validation Function produces at the user option a "LOG" file and a "LOGMSG" file. These two files are the basis for the Log-Trace Facility. The LOG file for a job contains three type of information:

1. Status of the job's validation run
2. OS Job start and stop messages
3. OS data management supervisor messages

If a failure occurs it also has information about which script record it was on when it failed.

There is also a job name, date, time record at the beginning of each LOG file which is useful in the retrieval of a Log when the Output Stacking Facility has been utilized. If the user has a "stacked" set of Log files for multiple jobs and/or multiple runs then various reports are available from the Output Stacking Facility.

The LOGMSG file can be used to provide a daily record of what jobs were submitted, what jobs have run, and what jobs are outstanding (i.e. "Missing In Action"). The LOGMSG file is used by JPP to indicate not only that a job has run, but also if additional jobs are submitted by the JPP job.

The records in both the LOG and LOGMSG files are date and time stamped which provide the information about what was run and the sequence which it was run in.

The LOGMSG files from the previous day's production runs can be combined and from the combined file a register is produced of what was submitted and/or run. From this daily register, the "Missing In Action" Report is produced as well as the "Stranger" Report. The "MIA" Report shows jobs that were submitted for which no disposition message is found. The "Stranger" Report shows jobs that have "Run" messages but no submission messages. IDPCS provides the user with a basis and a means for "management by exception" of the control environment. The Log-Trace Facility is the audit trail of what was submitted and run, and provides for:

- job submission logging
- job termination logging
- job trace reporting
- "Missing-In-Action" reporting
- "Stranger" reporting

OUTPUT STACKING FACILITY

IDPCS can be used to remove the stacks of paper sitting around in offices, closets, etc. IDPCS can place these listings on tape to then be printed off on an "as needed" basis. The Output Stacking Facility can operate in several different ways depending on the needs of the user. It can operate on datasets such as those left after the Job Post Processor has validated a job or jobs. These datasets must meet several user defined criteria. A dataset to be stacked must be prefixed with a high level index of the user's choice. The dataset must also meet the attributes that are specified by the user. The attributes are BLKSIZE, LRECL, RECFM, DSORG. The Output Stacking Facility checks the system catalog for datasets that meet the criteria, then builds a jobstream and submits it. Normally this job stream consists of two steps. The first step of the jobstream copies the datasets to tape; the second step deletes the copied datasets. Naturally, the jobstream is only submitted if there are datasets to be stacked.

The Output Stacking Facility also provides a means of stacking all jobs on the output queue (in TSO Hold Class) that belong to a particular user. This TSO USER-ID would probably be used only for this output stacking purpose. The stacking of "jobs" is done by causing all the jobs to be output into datasets, and then using the regular stacking process. The Output Stacking Facility is the historical record of each job run and provides for:

- spooling to tape of validated and/or unvalidated job outputs
- retrieval of spooled output by date and/or job name
- reporting from spooled output (average real time, average cpu time, etc.)
- queued output selection for spooling

SUMMARY

The Integrated Data Processing Control System is a production control support utility system which can assist control personnel in the performance of the jobs. The concept used in IDPCS of one job "evaluating" the results of another job has many other uses. The ability to select alternate processing paths with this concept, makes the potential uses almost endless. This paper has explored only one of the many potential applications of this concept.

ONE PROFESSIONAL'S EVALUATION CRITERIA FOR HIGHER EDUCATION COMPUTING:

HOW DO YOU RATE?

An interactive session with audience
participation and discussion invited.

Presentation by Frederick A. Gross, President
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Four Country View Road
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December 3, 1981
CAUSE '81 National Conference, Track VI

Criteria used by a (Private Sector) computing professional to evaluate data processing in some 200 colleges and universities are discussed. Key factors relating to successful operations as viewed by the professional, the institution or client, and actual users are reviewed. All computer resource related areas are explored—academic, administrative systems, personnel, management, computing budget, return on monies invested, etc. A summary of related findings, along with evaluation criteria, provide a succinct review of current 1980's ROI and state-of-the-art in higher education computing. Accountability and evaluation criteria include: user satisfaction; staff motivation; cloning (training replacement); budget control; technical delivery; and return on investment.

ONE PROFESSIONAL'S EVALUATION CRITERIA FOR HIGHER EDUCATION COMPUTING:

HOW DO YOU RATE?

Let me first emphasize that my observations, evaluations, and recommendations are generic to higher education computing nationwide. I want to begin by reiterating one of the many key points proposed by Dr. Arnold R. Weber in his keynote address, "The CEO's View of Administrative Systems." In this decade of the 80's, all of us are keenly aware that in light of spiraling inflation, budget cutbacks, stabilized student population, increased competition among sister institutions for quality administrators, faculty, and staff, and all those various influences which are impacting the realm of higher education, there is a critical need for thorough and proper evaluation. I'm sure Dr. Weber expressed all our sentiments when he challenged CAUSE attendees to "help me measure my return on the computing investment--my ROI." Therefore, expanding on Dr. Weber's theme, I will point out key ROI characteristics so that you will be better able to focus on whether you're getting your money's worth from your institution's administrative computing.

Two points need clarification before discussing any of the various return on investment (ROI) criteria. First, each computer center director and/or senior-level administrator responsible for data processing has a definition of ROI; therefore, it is important to remember that these are *strictly my selected criteria*. Secondly, the concept of ROI, as Dr. Weber has already indicated, is not only a critical computing issue for the 80's, but it constitutes a most appropriate CAUSE special presentation theme. It represents a common denominator between all colleges and universities--regardless of type, size, mission, and, of course, budget. It also constitutes an aspect of the higher education function which can definitely be measured. On these bases, my agenda for today evolves around two basic themes. First, I want to share with you my *opinion of ROI* and *how I view and assess* both sides of the return on investment formula. This involves first examining the investment side, and more importantly, *how it is measured*. I will share with you some of *my findings*, and deal with some *possible solutions*.

A second major theme will be to provide you with some insights on *how to assess your own ROI* so that you can apply them to your own staffs and unique operational environments.

As President of Systems & Computer Technology (SCT) Corporation, of Malvern, Pennsylvania, my experience and background encompasses thirteen years of extensive involvement with and participation in higher education. Since 1968, I have surveyed or worked with over 300 colleges and universities—two- and four-year, large and small, public and private, single-campus institutions and multi-campus districts, from New York to California and Puerto Rico to Alaska. From each of these involvements, I have had the opportunity to identify problems and formulate solutions.

I have further had contact with people at all levels surveyed and client institutions, including DP directors; trustees; presidents and chancellors; vice-presidents for finance, administration, student services, and academic affairs; not to mention provosts, deans, department heads; computer guidance committees; both individual users and special interest groups; and faculty, staff, and students. In addition, I am privileged to have in my own organization over 100 former directors of college and university computing.

From the California Institute of Technology, the University of Southern California, and the San Diego and San Francisco Community College Districts in the West to the University of Illinois, The University of Texas System and Cuyahoga Community College in the Midwest to Genesee Community College, the Massachusetts Institute of Technology, and Temple University in the East, long-term engagements have given me ample opportunity to assess a broad range of problems and subsequently formulate and implement realistic solutions.

Let's first examine the investment side of the ROI formula. What are we spending nationally for administrative computing? Acknowledgements are due Chuck Thomas and the CAUSE organization, as well as The Chronicle of Higher Education for gathering and disseminating the following information:

THE INVESTMENT
BUDGET BREAKDOWN OF HIGHER EDUCATION: AN $80,000,000,000 INDUSTRY

AIS Budget as Percentage of Total Operating Expenditures:

- 5% of institutions spend less than 1%
- 28% of institutions spend from 1 - 1.9%
- 26% of institutions spend from 2 - 2.9%
- 17% of institutions spend from 3 - 3.9%
- 24% of institutions spend 4% or more

With average of 2.5%, then $2,000,000,000 is spent annually on computing nationwide.

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If we assume from this breakdown that the average institutional expenditure on administrative computing is 2.5%, then approximately $2 billion is spent annually on computing nationwide. While this is a broad estimate and certainly includes more than just expenditures for administrative computing, it nevertheless represents a sizable yearly investment for one of the most important functions within higher education today.

Further examining the investment side of the ROI formula, look at this budget breakdown on how we are expending this $2 billion dollars per year:

BUDGET BREAKDOWN OF HIGHER EDUCATION
AN $80,000,000,000 INDUSTRY

Average Percentage Breakdown of AIS Budget by Category:

- 53% of expenditures are for staff
- 28% of expenditures are for hardware
- 3% of expenditures are for software
- 2% of expenditures are for communications
- 14% of expenditures are for other

With average of $2 billion spent annually on computing nationwide, then $1,060,000,000 is for people.

My experience leads me to believe that although this 53% expenditure ratio for staff may be slightly high, there is no doubt that, with DP professionals becoming scarcer, this percentage may go as high as 70% in the next three years. My experience also indicates that the 28% figure for hardware expenditures may be low, especially in light of the "hardware revolution"-- i.e., smaller, cheaper, more powerful mainframes which are currently inundating the market.

The key point to be gleaned from these breakdowns is in the people figure. If approximately $2 billion is spent annually on computing nationwide, then, $1,600,000,000 a year is expended for people. That is a sizable investment for the variety of directors, managers, analysts/programmers, and clerical support staff necessary to operate higher education's computing resource.

Let's next examine the other side of the ROI equation—the return on that $2 billion investment.

If we were to take a snapshot of higher education administrative computing today, how many institutions would have student information, financial accounting and management, and human resources information processing in true data base environment. How many would be using the latest hardware and have an adequate high caliber staff operating under the best cost/performance ratio with a high computer literacy level of administrative users and would receive "A" or "B" grades for computer center responsiveness if users were polled?

Since this snapshot describes few, if any institutions, several imperatives become apparent. First, the concept of a "true" data base environment is without question the nationally recognized trend. In fact, it was the CAUSE 1980 National Conference theme. One year later, I wonder how many of last year's attendees recognized that concept as the wave of the future and have indeed planned for or achieved measurable strides toward that end within their DP centers.

The snapshot analogy indicates we are not getting a good return on that $2 billion invested. Let's examine the details of how I measure the return side of the ROI formula. What are we actually receiving for the $2 billion invested? In measuring this aspect of ROI, it is critical to identify what it is that should be measured.

My first measurement criterion is people, primarily because they represent the largest ROI formula expenditure—over $1 billion yearly. In examining staff caliber and personnel performance, it is necessary to break out the people resource into two groups—the management level and the technical staff. This distinction is significant because managers are accountable for the investment being made in the technical staff.

I evaluate my own directors and managers by asking the following questions: for my investment, do I have sufficient depth and experience levels? What kind of budget success are they promoting? Do I have an ombudsperson who is able to get the most from increasingly scarce funds and tighter budgets? Have they developed and implemented a comprehensive master plan which, in essence, is a "quality DP blueprint?" Are my managers using this master plan as both an evaluation tool on one side and an expectation tool on the other? Is each manager creating his own clone—a true, equally-capable peer who could adequately fill his shoes—within an acceptable timeframe and without loss of professional capability or performance?

From a technical staff perspective, I examine several related indicators by asking: Do I have sufficient depth and experience levels? Do I have people who exhibit both technical expertise and professional commitment? Are they involved in development and training activities to stay abreast of current technology? What waste coefficient am I experiencing in turnover? How much time, money, and knowledge am I losing when people leave and I'm forced to restart projects?

My second measurement criterion is what I term administrative systems responsiveness. I choose this criterion because it's why data processing centers are in business and it is undoubtedly the most highly visible aspect of your DP operation.

To begin this assessment, I focus on the current state of administrative systems in an institutional environment. What do we have working—right now—today? Do we have fragmented, static systems which are not linked and which are draining hardware and people resources, or do we have an efficient, integrated, data base concept?

If we are changing from the old, obsolete technology to the new data base concept, which data base is being selected to adequately respond to user needs, and at the same time accommodate the necessary potential for cost-effective systems development?

Do we experience recurring high maintenance costs on existing systems or are our budget and people resources dedicated to development of state-of-the-art, on-line systems? Other related questions include how much maintenance development as opposed to development activities is acceptable? 80% vs. 20%? 60% vs. 40%? Are jobs produced on time and within budget? How many dollars are expended yearly to maintain obsolete applications? Are our current systems batch-oriented or, at best, a make-shift combination of both batch and on-line configurations as opposed to a truly interactive, state-of-the-art, data base applications environment?

All these considerations are related to administrative systems responsiveness and lead to the need to evaluate our administrative systems problems, and consequently lead us toward a "make or buy" decision. Should we "reinvent the wheel" in-house, knowing that millions of dollars must be utilized to build such systems from scratch? If we buy outside, what applications best fit the needs of our institution's users?

We all recognize the scope of these decisions, but I question whether we recognize the trend to cost and time savings realized by purchasing already-developed software applications which can be quickly and cost-effectively fine-tuned to meet unique institutional needs?

Let's look next at my third measurement criterion—hardware utility performance--which represents approximately 28% of higher education's national computing budget. On the surface, it would appear to be relatively simple to gauge whether or not your hardware is performing. But is it really that simple?

When you assess hardware responsiveness, one of many aspects to consider is reliability. In addition, is there contention between administrative and academic users of this hardware? Are you buying more cycles to overcome poor software? All of these issues complicate any evaluation of hardware performance.

Experience has shown me that the one most visible aspect of hardware evaluation is most frequently overlooked. Consider your hardware from a cost/performance perspective. Have you purchased current hardware technology at today's reduced prices, or do you have older hardware technology purchased years ago under long-term financing stipulations? This is why I point out to certain institutions that they are "locked in" to what is already obsolete today for the next three to seven years!

I classify my fourth measurement criterion as user satisfaction level. Experience again shows me that many institutions do not evaluate this criterion objectively when they measure ROI. The users are your customers and, as I suggested before, the very reason you're in business.

There is an excellent way of evaluating how well you are performing in this respect. Go to your filing cabinet, pull out the "plaudits" and "implaudits" files, and compare them side by side. Are there more complaints than commendations? Is there an equal representation distribution among registrar/admissions, comptroller, payroll/personnel constituencies? This perusal can be much more revealing than merely counting "well dones" or complaints. Plaudits/implaudits records will provide you valuable insight into the level of user "computing literacy" within your institution. It goes without saying that those user groups you have educated to both the potentials and limitations of your DP center are those most willing to understand your problems and accept whatever shortcomings they (and you) might be experiencing.

A vote of confidence is one way to test user satisfaction levels. Simply ask them: would they rehire you? Then ask how they measure the responsiveness of your new systems? Are they impressed with the operations and production reliability of your center?

Do they have confidence enough in you to ask you to diagnose and redefine their needs, or have they ever suggested that you buy consultation services from the outside to assist in diagnosing your own center?

To summarize, my four measurement criteria on the "return side" of the ROI formula are the areas of staff, systems, hardware, and user satisfaction. I strongly suggest you apply all four measures to your individual institutions. You may be surprised by what you find.

Let me now share with you some typical findings which result from application of these four ROI measurement criteria. Remember the bases upon which I can draw such conclusions: surveys and evaluations in over 300 institutional settings—large and small, two- and four-year, private and public, single campus and multi-facility districts, throughout the nation; remember that my findings reflect what I have discovered in a majority of institutions—not an isolated exception here and there. Accurate as my findings may be, they should not be misconstrued as criticisms; they represent a basically "inherited" set of conditions.

When I examine staff caliber and performance, I frequently find only one senior manager or key technical person, with no clone "in the wings" who has comparable depth of experience. This puts any DP center in a vulnerable position; two minds are certainly better than one, and a management team of three is certainly better than two. Also, I find either a nonexistent or outdated master plan typified by lack of control over expectations and priorities, and the untenable position of not being able to evaluate computer center performance.

I have further found an interesting dichotomy: in some settings, there is no turnover; in others, annual turnover has reached as high as 50%. This, no doubt, explains why, on the average, turnover in the higher educational data processing environment is approximately 25%, but I contend that whether 0% or 50%, both environments are in trouble. In one case, personnel have become stale; in the other case, in addition to costly waste, the center has become a training ground for DP professionals drawn away by private sector and industry competition.

I suspect the low expertise level that I so frequently run into is not only a direct result of turnover from industry competition, but probably also reflects minimal staff development and in-house training programs to keep DP personnel skills current with state-of-the-art technology.

When I apply my second ROI evaluation criterion—administrative systems responsiveness—I find the vast majority of higher educational institutions have a "patchwork quilt" of fragmented, static, non-linking applications. Believe it or not, more than 50% of these systems feature 1960's software, with the corresponding high user manual direct labor costs, extreme frustration, and thousands of programs!

Because these systems are mostly batch or on-line makeshifts, the "cry from the field" is for conversion and more conversion! Today's state of the art is data base technology, and DP professionals in higher education certainly do not want to catch up with today's technology five to seven years from now.

Fragmented, obsolete software explains my third finding—a high maintenance profile which creates two major problems. First, there is a large documentation task associated with these older systems and second, the resulting turn offs of technical staff personnel. When they come to realize that the great majority of their time is spent in maintaining an outdated application, the lure of high salaries and of a creative, challenging, exciting environment in industrial data processing becomes more compelling.

My experience verifies the trend toward buying new applications when institutions are faced with a make or buy decision. It's interesting to note that last year's National CAUSE Conference reinforced that posture, and I have subsequently found less reinvention of the wheel. In fact, even the larger, prestigious schools, such as the University of Illinois, Temple University, USC, and The University of Texas System, have opted to purchase administrative applications in spite of all their resources. What I do find curious is that not all institutions are actively and aggressively pursuing this prudent, cost-effective approach.

From a hardware utility performance perspective, I unfortunately find a major emphasis toward buying more cycles. This appears to be an attempt to solve the contention problem between academic and administrative users, which is basically a software problem. On a more personal level, I conjecture that, in some cases, it's a futile effort to ease the guilt of not adequately answering user needs.

I have further discovered an inordinate, nationwide investment in old technology, with the restrictive encumberence of long-term financing associated with those products which are already obsolete. This limited hardware capability serves to further fuel administrative contention and frustration, while also creating a trend toward proliferation of mini's and micro's as a way of offering to users a "band aid" solution.

Applying my fourth criterion, user satisfaction level, produces some of the most interesting—and alarming—findings. In a great majority of cases, the customers are simply not happy. The "implaudits," user-complaint file dominates, because in most cases there is one user that gets preferential treatment. I call this the "favorite user" syndrome.

I inevitably encounter a low level of user computing literacy, due in most cases to lack of budget and support staff.

When I ask users if they would rehire their DP management, I receive mixed reactions. In rating these findings, there is a level of satisfaction in the responsiveness of new systems; there is mixed confidence relative to production reliability; and unfortunately, a low level of confidence in their perceptions of the DP center's diagnostic and consultation services. All these factors have contributed to the new trend toward decentralized staff growth based simply on user frustration with the central MIS function.

I am convinced that, on balance, if you were to apply my findings candidly, you could not help concluding that on a national scale, the return on the $2 billion a year administrative computing investment is low!

How can we begin to adequately address the appalling waste resulting from such a low return on our computing investment? Let me suggest some applicable, proven solutions.

First, it is necessary to apply the various measurement tools that I have outlined today to your current environment. Before anyone can establish a "solution environment", staff, systems, hardware, and user satisfaction must be honestly and objectively evaluated.

When these four areas have been assessed and documented, you can begin defining and implementing solutions.

Step one is to meet with your internal staff, sharing candidly with each of them your findings. Do not blame your institution's administration, but meet with the intent of explicating the problems and subsequent requirements. Outline a solution matrix, priorities, and, of course, budget allocations necessary for these proposed improvement steps. There is absolutely no need to pay a consultant a large fee when there is assistance available from both software and hardware firms (which incorporate assessment and planning activities as part of standard services delivery), or from your colleagues in sister institutions who have already experienced such an improvement process before and who would undoubtedly offer advice for a reasonable fee.

Secondly, meet with all user groups to clarify the defined problems and requirements, and to share with them your proposed solutions. At this point, it is imperative to request a vote of confidence in these planned improvements, because without it, the solutions will never work.

The third step is to meet with the appropriate governance, to outline again problems and requirements and proposed solutions. This may be the most difficult task, because it involves actually selling—and "selling" is the correct word—your computing improvement program. It is important to remember that part of your sale must be to convince decision makers that your computing improvement program must become one of the highest institutional priorities and that it is intricately tied to the administration's mission. Request the required budget allocation and carefully and thoroughly clarify any expectation issues.

Using this aproach, you reaffirm computing authority and embark on a computing improvement program in an assertive posture. These solutions must be pursued to improve the return on our administrative computing investment.

THE SYSTEMS ANALYST ROLE REVIEWED: AN ALTERNATIVE APPROACH

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The elements which contribute to the overall "success" of any computerized administrative system within the university environment are numerous. The environment itself, including the history, size, and goals of the institution, the organizational and political nature of the institution, the "maturity" of the administrative offices in dealing with a computerized administrative system, and the design and implementation methodology utilized all impact this "success" goal.

There are several roles which have been traditionally defined to deal with all these elements. This paper will present a review of the traditional definition of the Systems Analyst as it impacts the elements of failure for systems and present an alternative approach which has been implemented by Pepperdine University.

INTRODUCTION

The basic objective of each of us involved in this conference is the development and employment of successful information systems. The success of the information system can be measured by the degree which the system provides support to the functions associated with the primary objective of the institution.

Using this broad definition of success, we can see that there are many elements which contribute to the success of an information system. The environment, including the history, size, and goals of the institution, the organizational and political nature of the institution, the "maturity" of the administrative user offices in dealing effectively with an information system, and the technical and economic resources available and the methodology utilized in transforming them into contributive support mechanisms - all these elements impact this "success" goal.

This paper will outline the basis of the causes of failure, with particular emphasis on the socio/organizational causes, will relate these causes to the traditional role of the Systems Analyst, and will present an alternative approach to this role which has been employed at Pepperdine University.

CAUSES OF FAILURE

As information processing professionals (regardless of whether we work in the Data Processing Department or in an administrative office) we can be proud of the advances which we have made in the technical area: Hardware advances, including more powerful mainframes, micros, minis, distributive data processing, and networking: Also Software advances, including integrative processes, management information systems, graphics, gaming, modeling, data base technology, and end user report generators.

While these technical advances in data processing are good and can be applied successfully to an information system, it is the thesis of this paper that they are not determinative for success. While we know of applications where institutions have successfully used these tools, we also know of cases where given the "best" of technical tools, we have "unsuccessful" systems. Conversely, we also know of instances where given the poorest of technical tools, we nonetheless have "successful" systems.

Given this background, then, what are the major causes of failure in systems? I can discern several:

Institutional

1. As we progress in the systems efforts, we are developing more complex systems with a co-commitment requirement for more resources from the organization. Two examples of the impact this element has on the organization follows:

    Transparency. Oliver Wright(1) in his recent book suggests four important systems principles for success - accountability, data integrity, validity of the simulation, and transparency. By "transparency" he means that the user must be able to understand the inner workings of the system - that the system not appear as a "black box". The basic concept is one which states that the better people understand the system, the better they will use it. This requires a high degree of training and documentation. The more complex the system, the more resources in this area need to be dedicated by the institution. This is particularly true of institutions experiencing a high degree of turnover.

Integration. As institutions move toward more comprehensive and integrated systems, there is a higher demand for cooperative behavior among the various sub-structures participating in the system. When designing information systems, MIS designers often overlook the realities of organizational disunity within the institution and thus encourage failure within the systems they construct(2). DeMaio(3) suggests that MIS designers need to employ "a more systematic approach" to systems design which will allow for the input of these "social" variables.

Data Processing

2. Earl and Hopwood maintain that we still tend to view information as a technical phenomenon and thus call for a new perspective, "from a concern with information as a technical phenomenon to a concern with information management as a substantive organizational phenomenon".(4) Mumford elaborates on this concept with the introduction of the concept of the "socio-technical" structure.

> "The concept of a socio-technical system is derived from the premise that any production system requires both a technology or process for transforming raw materials into output, and a social structure linking the human operators both with the technology and with each other. A socio-technical system is any unit in the organisation composed of a technological and a social subsystem having a common task or goal to accomplish. If we are concerned with clerical systems based on the use of the computer, the technical system will consist of the tools, techniques, and procedures used for processing the raw materials of information. The social structure is the network of roles, relationships and tasks which interact with the technical system. The purpose of the socio-technical system approach is to produce technical and social structures which have a high capacity to achieve technical and social goals and which reinforce each other in the achievement of these goals."(5)

Such a perspective on the part of information managers will enforce the fact that we can no longer view information processing as just what goes on inside the computer. What we have long known as the "provision of computing services" will need to be redefined in terms of the "provision of information services"(6), accompanied by a change in many of the traditional roles assumed by managers, system designers, and the data processing network as a whole.

Relationships - Role Models

3. The final constraint to the employment of "successful" information systems which I will mention, and one which impacts the above listed constraints, lies in the area of the relationships between the users of the technical system and the controllers of the system.(7) This relationship can probably be best illustrated by the traditional role model of the Systems Analyst which has been established to relate to the technical system on behalf of the users.

Role Model - The Systems Analyst

As mentioned previously, there is a tendency for the role model of the traditional Systems Analyst (SA) to not recognize the "whole" environment within which information systems are to function. It is my thesis that there are also some relational characteristics built into the SA role which also contribute to the failure of information systems. These characteristics can be developed as follows:

1. Management requires management support, i.e., support which is as knowledgeable about the application area as it is about the technical environment. The thesis of this statement is that it is a more difficult task to translate management needs into system requirements than it is to

design "good technical systems". Due to this, we have found that the best "translators" at Pepperdine have not been the ones with traditional data processing backgrounds, but ones who have grown up through the user community and have migrated into the data processing environment.

2. The information processes within an organization, at both the departmental and corporate level, are dynamic and require on-going translational support. However, this is not the way we traditionally provide translational services. Most authors speak of the SA as individuals which are project oriented rather than client oriented. While project orientation can leave management and users with a sense of abandonment, client orientation will lead to a sense of continued support.

3. The relationship between the technical processes and the socio/organizational processes and within the socio/organizational processes themselves, may not always be apparent to the manager or to the end user. To this end management requires at times a pro-active participation by the translator rather than a re-active. To the extent that projects are traditionally assigned to the SA "from above", the SA is reactive in nature. This role will have to be supplemented or changed to become an active force in realizing and motivating changes within the technical and social/organizational systems.

Courbon differentiates between "Type P" (for transaction processing) and "Type S" (for support) systems and delineates a different level of support for each.

> "The [Type p] designer is involved in a change process,... a political process, a socio-technical process and a learning process. All this research indicates that the designer's role as a change agent is becoming paramount....

> It is argued here that a new breed of designers will emerge for managerially-oriented systems [Type S]. More than becoming change agents, they will have to be nurturing agents. This means that designers will be involved in the whole information environment with managers. Designers will follow managerial learning processes, support the manager's continuous adaptation to constantly changing situations and help in intelligence building. This view also obliges information systems departments to adapt their modes of intervention. Designers will be "sent" close to managers or operational/functional departments and act like craftsmen in very small teams or alone."(8)

In order to relate this conceptual framework to the realities of organizational life, I would like to explore how Pepperdine has adapted many of these concepts in the role of what we call the Information Systems Coordinators (ISC).

An Alternative Approach to the Systems Analyst

While organizationally the ISC's report to the Director of the data center, operationally their primary concern is to the user community. In this regard, the ISCs are both project oriented and client oriented. While they may work on individual projects, the ISCs continually keep tabs with the "real world" of the user offices by acting as the major link between the user offices and the Data Center, monitoring error reports and pro-offering advise to the user community on existing or potential problems. The ISCs thus maintain a high level of visibility within the user community and are known for their service orientation. The primary functions of the ISCs are:

1. To assist managers within the client community in planning for future growth and use of administrative systems. Pepperdine is currently in the process of converting all the major administrative systems applications from a batch mode to on-line. At the same time, project areas subject to automation but which are not yet automated are being developed - relationships established and "blue-sky" discussions encouraged. Major

generic applications are also being planned for, including institution-wide word processing, networking, administrative graphics, gaming and modeling, and a limited concept of end-user programming. The ISCs are continually working with individual managers in planning for these applications.

2. To insure that the user community is receiving an appropriate level of service from the data center. Of course, the definition of what is "appropriate" is relative and is often the source for discrepancies between the user community (via the ISCs) and the data center. Given all things equal, it is the job of the ISC to fall on the side of the user community and to thus reflect their needs and concerns in such situations.

3. Closely tied to this function is the function of insuring that the user community has a realistic level of expectations concerning the resources available within the data center and the level of service to which they are thus entitled. Assuming that the user is obtaining an appropriate but not adequate level of service, this usually takes the form of an admonition for the user to politic with their representative on the Systems and Planning Committee (for major projects) or DAG (for minor projects), since these committees establish the level of resources available within the data center.(7)

4. In terms of technical systems development or modification, the ISC is responsible for ensuring that the generic and functional needs of the users are addressed in the design and project stages where appropriate. On a project basis, this normally translates into informal, if not formal, project management. It should be mentioned here that the ISCs normally exercise quite a bit of editorial control in assisting the user in determining their needs. But this is always done in accordance with an

attempt to "nurture" the user into crystallizing his/her "true" needs (vis-a-vis "perceived" needs). If this is not successful, i.e., if the user and the ISC cannot agree on what the "true" needs are, the issue is resolved at a higher level.

5. The technical systems design function is usually performed by the most appropriate person on a project basis. For small projects or simple modifications to existing systems, this is usually performed by the ISC. For larger projects where substantial changes are being made to the philosophies of the systems, the design is usually performed by the programming staff as a unit, spearheaded by the manager of the programmers. However, it is the overall responsibility of the ISC to insure that whatever design work is necessary is being performed and to monitor this work to insure that the user interests are being observed.

6. There are various levels of user sophisitication within the user offices, each requiring a different level of assistance in designing forms, writing procedures, interfacing with the data center, and in relating information needs within their department to possible solutions (technical or socio/organizational). The role of the ISC is two-fold in this area. First, it is the responsibility of the ISC to see that the assistance needs in these areas are fulfilled, and secondly, to act as "maturing" agents to assist the office, via training and recommendations for action, in developing within their own office the required resources in these areas over time. It is also the role of the ISC to insure that there is an effective utilization by the user offices of the existing computer system capabilities.

Pepperdine currently employs three ISCs whose individual responsibilities are divided by user group, as follows:

ISC	ISC	ISC
Finance	Registrar	Financial Aid
Payroll	Schools	Development
Personnel	Student Affrs	Student Accounts
Fac Mgmt	Admissions	

While this serves as a formal definition, all three ISCs constantly overlap in user community communication and coordination. This is especially true, for instance, when one ISC is out for a few days. The slack is picked up by another designated ISC.

In summary, then, it has been proposed that as our institutions change and as the Data Processing industry advances, that we are going to have to re-evaluate the way that we provide computing and information services. This is especially true as we go more and more into management information and decision support systems. Pepperdine has derived the role of the ISC in response to such a re-evaluaton.

FOOTNOTES

1. Oliver Wight, MRPII: Manufactoring Resource Planning, CBI Publishing Company, 1981.

2. K.M. Hussain and C.R. Thomas, "Organizing Information Systems" in Management Information Systems For Higher Education, edited by K.M. Hussain, Organisation for Economic Co-Operation and Development, 1977, pg 181.

3. Adriano DeMaio, "Social-Technical Methods for Information Systems Design", in The Information Systems Environment, edited by H.C. Lucas, North-Holland Publishing Co., 1980, pg 108.

4. M.J. Earl and A. G. Hopwood, "From Management Information to Information Management", in The Information Systems Environment, IBID, pg 5.

5. Enid Mumford, "Participative Systems Design: Structure and Method", Systems, Objectives, Solutions, January 1981, pg 14.

6. Robert G. Gillespie,"A Consensus Statement: The Panel on Computing and Higher Education", EDUCOM, Summer 1981, pg 25-26.

7. Pepperdine has built several control and use models, both at the corporate level and at the individual level. For background information regarding the corporate (committee) control model, reference the work of James Penrod and John F. McManus, Decision Support Systems, Proceedings of the 1981 CAUSE National Conference (St. Louis: 1981).

8. Jean-Claude Coubon and Marcel Bourgeois, "The Information System Designer As A Nurturing Agent of a Socio-Technical Process", in The Information Systems Environment, IBID, pg 147.

ISC PRIMARY FUNCTIONS

1. ASSIST ADMINISTRATIVE MANAGERS IN PLANNING FOR FUTURE
2. INSURE APPROPRIATE LEVEL OF D.P. SERVICES
3. INSURE REALISTIC LEVEL OF EXPECTATIONS BY USERS
4. INSURE GENERIC AND FUNCTIONAL NEEDS ARE ADDRESSED
5. INSURE APPROPRIATE TECHNICAL SYSTEMS DESIGN
6. ACT AS "MATURING AGENTS" FOR USERS

A SUCCESS ROLE MODEL

1. MUST RECOGNIZE "WHOLE ENVIRONMENT".
2. MUST PROVIDE MANAGEMENT LEVEL SUPPORT.
3. MUST BECOME CLIENT ORIENTED.
4. MUST BECOME PRO-ACTIVE.

CAUSES OF FAILURE

INSTITUTIONAL	LACK OF EDUCATION AND SUB-STRUCTURE COOPERATION
DATA PROCESSING	PERSPECTIVE ON PROVIDING "COMPUTING SERVICES"
ROLE MODEL	BACKGROUND AND PERSPECTIVE OF TRADITIONAL SYSTEMS ANALYST

FINDING AND KEEPING PERFORMANCE-ORIENTED INDIVIDUALS

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Finding and keeping performance-oriented individuals is a subject of growing interest in an atmosphere of inflation, wage-price guidelines and seven percent increases. It challenges management to review its attitudes on career issues, strategy planning and affirmative action. Traditional methods of evaluating employees for promotion involve describing and nominating only those who resemble persons already successful in the positions for which the employees are being considered. Models, not positions, are evaluated, thus clear qualifications or skills are not considered. Proper human resource management helps to eliminate prejudiced, and biased ways of evaluating people for positions. There must not only be general qualifications for positions, but also individual evaluation of these qualifications. Lines of progression and promotion policies should be established and applied equitably, for performance-oriented individuals seek other employment because of the mystery that surrounds the worth and value of a job. Compensation must not be on the basis of "point voodoo" rather than marketplace dollars. Reinforcement patterns which let employees know both what is expected of them and when they are achieving must be established. Performance-oriented individuals want to know what experience, training and developmental programs are established to help them reach their goals. They must be given an unbiased opportunity to demonstrate the level of their ability to perform.

FINDING AND KEEPING PERFORMANCE-ORIENTED INDIVIDUALS

Finding and keeping performance-oriented individuals is a subject of growing interest in a atmosphere of inflation, wage-price guidelines, seven percent increases, etc. It is also a matter which challenges management to review its attitudes on career issues, strategy planning, and affirmative action.

At a recent seminar on planning career strategies in organizations, a survey of managerial attitudes was taken. The questionnaire on the following page is representative of the types of attitudes surveyed. Take a few moments to respond to the questionnare.

Now, while your attitudes on career issues are actively working, consider this situation: In the spring of 1979, Bill Lucas, a young executive with the Atlanta Braves' Baseball Team, suffered a sudden stroke, heart attack, and died. Bill was an athlete, supposedly strong and healthy, only 43 years old, but he died and left a vacancy in the Braves' executive management team.

Suppose that your college president or your department chairman was suddenly stricken. You have been asked to nominate a replacement. You know that your college needs a person who is a dynamic, proven leader; one who not only has the ability to make decisions, but who is also willing to take responsibility for those decisions; one who has in-depth college and community knowledge, as well as technical competence. Your candidate must be emotionally and physically stable, having a generous capacity for stress endurance. Of course, your candidate must have both proven management ability and ability to motivate others.

MANAGERIAL ATTITUDES ON CAREER ISSUES

	A	SA	?	SD	D
1. I believe the college or university has an obligation to provide a lifetime career plan for every employee.					
2. One should have made one's career choice by the time one is 30 years old.					
3. One can change to a better job after the age of 50.					
4. It is difficult to satisfy young college graduates because they want to get ahead fast.					
5. Employees need not inform me of their career aspirations.					
6. Promotion and transfers should be strictly according to set rules.					
7. At this point, getting racial minorities into managerial or staff positions, as opposed to women, is a more challenging problem for line management and officials.					
8. Women are intimidated by virtue of their sex in matters of appraisal, promotion, and/or their work-related activities by male organization members.					
9. Women supervisors tend to be tougher with female subordinates than in their relationships with male subordinates.					
10. Women tend to be less agressive than men when it comes to upward career mobility and are more prone to "let things work out by themselves".					

KEY: A - Agree
SA - Slightly agree
? - Not sure
SD - Slightly disagree
D - Disagree

Write down the name of your candidate.

My candidate is ____________________.

How many of you have just written down the name of a black woman? A white woman? A black man? A white man? I am sure that an overwhelming majority of your nominees fall into the last category. Why? The answer lies in traditional methods of evaluating models and predictors. This evaluation process involves describing and nominating those who have already been successful in the job for which the applicant is being considered. In other words, a person rather than a job is described, and the person described is usually a white male. This is known as the "white male model syndrome," and it is closely related to the "Board of Trustees syndrome" or selecting an applicant on the basis of how high up in the college he is likely to advance.

Thus, finding and keeping performance-oriented individuals is a tough job because those who are not white males or those who do not satisfy the particular affirmative action need of the day are often overlooked. We think in terms of a model, not a position. We are not considering clear qualifications or skills; we have no imperical way of evaluating the job, for we are looking at the person who is already filling the position. Proper human resource management helps to eliminate prejudiced and biased ways of evaluating people for positions.

By exploring some of the questions on the questionnaire, we uncover additional reasons why finding and keeping performance-oriented individuals is difficult. Consider the second question: Is it really necessary to make one's career choice by the age of thirty? The Bakke Decision (Regents of the University of California V. Bakke, U. S. Supreme Court, 1978) that made "reverse discrimination" headlines really had nothing to do with race. In fact, according to the EEOC, there is no such thing as "reverse discrimination"; there is only discrimination. Allan Bakke, a 38-year-old NASA engineer was considered by the University of California at Davis Medical School to be too old. His qualifications for admission were generally higher than those disadvantaged minority candidates who were evaluated under a special admissions program. The fact that a fixed number, 16 out of 100 places, was retained for special admission helped Bakke win his case. The Davis Medical School actually felt that Bakke was too old, over 30, to make a career change, especially as dynamic a change as becoming a doctor.

Question three, one can change to a better job after the age of 50, is closely related to this subject. In the case of Rodriquez V. Taylor, Third Circuit 1977, the plaintiff, who was 46, applied to take the competitive exam for the position of Security Officer. His application was denied because he was considered to be over age. The court held that it was impossible to evaluate his qualifications without the exam, and he was given it under court order. Even though he failed to score high enough to have been hired at the time of his application, the Third Circuit held that Rodriguez was entitled to back pay for the period between his application and his ultimate failure on the test. His employer's refusal to permit him to compete for the position represented a violation of the Age Discrimination in Employment Act. There must not only be general qualifications for positions, but there must also be individual evaluation of those qualifications.

Look now at question six: Should promotions and transfers be strictly according to set rules? As a condition for receiving government contracts, Crown-Zellerbach was instructed by the General Services Administration (D.C. LA. 1977) to switch from a departmental seniority system to a plant-wide seniority system. Even though the departmental system was entirely lawful, the court held that the government could demand a change in the seniority system as a condition to receiving a federal contract award. On the other hand, Caroline Paperboard's strict lines of progression from entry level positions through foremen and supervisors were upheld in court (Fourth Circuit, 1977) because the business necessity of Caroline's system was established by demonstrating that the skills required at every job level of the progression were learned through the experience of working at each lower level job.

These court cases simply tell us that there should be established lines of progression and promotion policies, and they should be applied equitably. If there are strict rules, then there must not be exceptions to the rules; they must be applied equally across the board to everyone. Under these conditions, everyone, at least theoretically, has a chance to advance. Performance-oriented individuals are looking for established criteria. How are people evaluated? What standards or guidelines are used? Is the application of these standards the same to all? Are age and sex used as criteria for promotional consideration? A performance-oriented person wants to know both the rewards and the investment of time associated with the job.

Of course, your rules for promotions and transfers may vary if your college bids for federal contracts or is otherwise involved in affirmative action.

But do your rules affect your finding and keeping performance-oriented individuals? Reflect on this question while you return to the questionnaire.

Questions seven through ten deal with women. Do your attitudes toward women subconsciously affect your finding and keeping performance-oriented individuals? Are your Black executive employees in charge of EEO and other administrative, powerless staff positions? How many minorities and women have line management positions with real authority? Do your female managers manage other females? Are there so few minorities and women who make over $20,000 a year that you can name them? If you find yourself answering affirmatively to any of these questions, you are probably having a difficult time finding and keeping performance-oriented individuals.

Consider EEOC v. Dupont, 1978. Dupont had difficulty in employing a representative percentage of minorities; EEOC argued that the appropriate labor market should be determined by drawing concentric circles around the job site, noting the number of employees who live within this particular area and then relating the resulting figure to the number of minorities within the population of the same area. This job market, weighted according to the population, was 16.9% black. Dupont was told that they should have that same percentage of minority employees. But the EEOC lost its case. The EEOC had looked at the population figures alone. They had not considered available skills; they had not evaluated the labor force, they did not consider commuting patterns. All of those factors are a part of what has to be evaluated when you are considering those who meet the particular affirmative action code of the day. In contrast, through an evaluation of Standard Metropolitan Statistical Area census data which considers commuting patterns and available skills, DuPont determined that the black work force was 11.2%, somewhat lower than their existing work force minority population.

Compensation problems are also of major consideration in employing and retaining the kind of employees that will make measurable contributions toward the success of your college. Compensation problems are highlighted by high turnover, inequities with regard to both salary and wage administration and work distribution and assignment. This has caused an increasing number of unions to appear on college campuses.

Often performance-oriented individuals leave because of the mystery that surrounds the worth and value of a job. The valuation of jobs is often on the basis of "point voodoo" rather than on marketplace dollars.

We can counteract the element of mystery be setting up some reinforcement patterns that will let people know what is expected of them and when they are achieving. In other words, we will institute real human resource management. And, in order to increase our effectiveness, we will automate this process so that we will eliminate the element of subjectivity. Employees leave when they feel that they are not being evaluated on an impartial basis. They consider the standard 7% increase, and they feel that they can do better by going to another college. Although the act of changing jobs may net a higher increase, establishing and achieving career goals often keeps performance-oriented individuals from leaving.

Human resource management has become increasingly important in finding and keeping performance-oriented individuals. Government laws are greatly responsible. ERISA refers to a pension and benefit law passed in 1974. When Studebaker closed in 1964, there was no money for pensions and benefits. International Harvester was able to determine statistically that it would be advantageous to allow employees 55 years of age with ten years of service to retire early. Those figures were available because the ERISA system was computerized, automated. So the law prevents recurrences of the Studebaker incident and created a return on investment for International Harvester.

Equal Employee Opportunity has been the big factor in human resource management. In the 50's, there was voluntary compliance; organizations were left to do whatever they wanted to, hire as many minorities and women in positions as possible while considering the handicapped, the veterans, and the aged. But in the 60's, legislation was passed and the previously voluntary compliance was backed by law. During the 70's, the government has been enforcing this legislation, and that is why there are currently so many cases which illustrate what has already been accomplished. In the 80's, results will be required. How real is equal employment opportunity at your college? Look at the population, at the work force, and at your utilization. In the 80's, statistical information needs to be available in a way that is convenient, impartial, and accurate.

The privacy issue is receiving great attention in the 80's. Employees want to know what professional and personal information is being retained. They want to see it and to know whether their handicaps and health records affect their opportunities for advancement and promotion. They also want to know their rights and their areas of protection.

In Occupational Safety and Health Administration, it is to your advantage to know whether or not a certain machine is one on which people are often hurt. It is also to your advantage to know whether or not the toxic level is such that it might be harmful.

Think of all of these alphabetically known government laws as helping the college run more efficiently and providing access to information more quickly and easily. That is human resource management and it is what performance-oriented individuals are looking for.

We have to recruit human resources. How are you recruiting? What are the sources you use? You have to realize that like people attract likes. We bring in the people that we know and with whom we are familiar. Thus, employee referrals favor select groups. How should we go about recruiting? First, we have to define the positions. The National Academy of Science has conducted a $200,000 study on equal pay for jobs of comparable worth. Equal pay for equal work, which women have fought for in the past, is not even an issue anymore. The issue now is how we evaluate a particular job. How do we define its worth to the organization? Job descriptions and requisite skills are increasingly important in the 80's.

Career planning is another factor. We have to plan careers, and counsel with individuals so that they will know what kind of career path they have. Performance-oriented individuals will want to know what they need to get ahead, what kind of experience, what kind of training, and what kind of developmental programs are established to help them reach their goals.

Management of human resources on a subjective basis, without automation, allows individual biases and prejudices to affect management decisions. Employees feel that they did not fit the management model and they complain that there were no predictors for how they would perform in the job. To combat this type of thinking, management must offer educational planning, training, and valid appraisal. Through computer print outs employees know exactly what skills help them advance. It is apparent that valid evaluation standards and training recommendations have been utilized.

With an automated evaluation system, the employee's skills are provided by the computer and matched with the available jobs. A candidate listing that does not have anything to do with age or sex or race is produced. This computer listing has considered all of the qualifications and determined the individuals best suited for the position. Thus, internal placement and promotion is possible. Those who stay with the college will be rewarded.

This method also helps identify skill deficiencies, for if the computer does not produce a candidate, training must be established. Planning goals that help prepare for future college management can be identified. If computerized evaluation reveals that there are no internal applicants, then external applicants can be evaluated using the same criteria.

Performance-oriented individuals do not always come in the size, shape, and color expected or in the one that comforms to the traditional role models. The job of finding and keeping them is not nearly so difficult if they are given an unbiased opportunity to demonstrate the level of their ability to perform.

General Methodology and Linear Model for Planning and Evaluation

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Development of a viable program or product to support a broad application area requires leadership, an articulated mission and a plan which includes a rigorous evaluation phase. Making leadership effective in turning a mission statement and guidelines into a program can be accomplished through a general planning methodology coupled with a linear evaluation model. Library automation is one area where this is particularly true, since integrated system support is now coming of age and there are many varying systems available from which to select. Clemson Library approached this problem by using a readily available planning methodology to articulate a general design followed by developing and implementing a linear model to evaluate various existing products. The planning method depends largely on a structured interview technique to provide basic data and synthesis for the conceptual design. Evaluation, in turn, depends on structuring a list of specific questions geared toward features analysis and hardware/software description. Coupling these two phases together results in the development of a relevant program while shortening much of the tedious and expensive systems analysis effort usually endured during application development.

Introduction

There are probably very few of you here who haven't seen the little cartoon with all the imps convulsed with laughter over the caption which says "You want it, when?" You've all, no doubt, also heard that long story which finally winds up with the saying, "There ain't no free lunch." Both of those stories capture in a few words the dilemma faced by all of us sooner or later when we're forced to recognize the extent of effort or cost involved in developing program support for some difficult application area. There is an enormous amount of work involved in getting from that vague certainty that you need to automate to the finished, operational program. Unfortunately also, not only is the program development effort difficult to quantify at the start, but it may vary significantly depending on the expertise of those involved, the approach taken, and the educational effort required to make sure everyone understands the problem.

To put it another way, the success of a systems project depends on having clear guidelines, good leadership, and a proven planning methodology. Leadership is required in order to hold the development process together and to make sure all those involved work on the elements they are supposed to. Guidelines are important as a means of defining the ultimate objective of the program under development. The planning approach itself fulfills the purpose of making it possible for objectives to be met and for leadership to lead. In addition, since a large number of systems have already been developed to support application areas in the educational arena, most systems design efforts should include an evaluation phase.

This paper reports on the two phase effort worked out at Clemson University to design a comprehensive automation program for the Library. Although the report describes a process on the basis of a specific application area which was the development of a Total Integrated Library Information System, the methods used are described in a general enough way that they could readily be applied to other application areas. Phase one is based on a version of IBM's Business System Planning methodology which is called the Application Transfer Team (ATT) study technique.[1] The second phase which was developed in conjunction with a library automation consultant is based on a linear model designed to compare the features of existing program systems to the general design articulated by phase one. Both phases dovetail with each other and can be viewed schematically. Before describing the planning methodology and linear evaluation model I would like to provide some background.

Background

The Library of Clemson University has the responsibility of acquiring, preserving, and making available, the materials needed by faculty and students in their research and instructional efforts. At Clemson, the amount of scholarly publishing and the pressure to develop research proposals have risen sharply in recent years causing library activity to double and requiring the growth of Library staff by seventy percent over the last decade. Furthermore, complex housekeeping tasks are compounded by a high inflation rate in the cost of materials and manpower.

Even though demands of users heavily burdened the traditional manual systems, the extent of Library automation at Clemson had been limited for many years. Although it was generally accepted for some time that the acquisitions function at Clemson was in need of automation, no concrete approach to developing a system had been established. In addition, there was some concern that the development of an automated acquisitions system shouldn't be initiated without a clear understanding of how such an effort would affect the rest of the functions in the Library. With this in mind, the Library administration decided to implement a structured study to determine specific needs and problems of the whole library at Clemson and to determine the attendent costs and benefits of their resolution as the initial part of systems design. Since developing the methodology for this kind of study effort in-house has been shown by experience elsewhere to be both expensive and time consuming, the IBM ATT study methodology was chosen as the basic planning technique. In order to implement the study, a team was organized consisting of representatives from the library, from the University's Division of Administrative Programming Services (DAPS) and from IBM.

There are several advantages to involving a team in creation of general design specifications, rather than following the typical approach of assigning the design effort to one person. First, the involvement of personnel from both the application area and the computer area provides an educational experience which allows the participants to develop a common understanding of the issues. Second, it provides a forum for the application of diverse expertise to the basic application problem. Third, the team approach also helps to develop a political environment which offsets many of the fears about loosing jobs to the computer.

Purpose

The Application Transfer Team methodology was implemented to fulfill a fourfold purpose.

First, it was necessary to develop a Library wide automation plan that Library and University administrators could use in the decision making process. Second, basic objectives and implementation estimates were required to provide groundwork for the development of systems specifications and evaluation. Third, the planning process needed to provide a forum for meaningful participation by a number of library staff and users. Fourth, the planning needed to be accomplished rather quickly. Although the ATT study technique is generalized to work on any problem in the education arena, it worked particularly well in the library environment because it is oriented toward developing applications which solve operational problems.

Although this methodology has been used several times in the academic environment, this is the first time, to our knowledge, that it has been used in a library operation. A major strength of the ATT is that it helps members of a team with diverse backgrounds to understand the environment under study. The methodology is so straightforward and effective that the process took Clemson slightly more than three months elapsed time. Total work time, including all report writing, for library staff was approximately one thousand man hours. The final result was an effective system design coupled with an enhanced awareness of systems problems by all those involved.

As the initial step with the methodology, it was necessary to engage a sponsor and to select a team. For this study, the sponsor chosen was the Dean of Graduate Studies, to whom reported all computer areas and in turn who reported directly to the Vice President for Academic Affairs. Although it was not critical that the sponsor be intimately involved in the project, his level of authority within the University administration helped to secure acceptance of the study's recommendation. The sponsor also provided cogent advice along the way, based upon his understanding of institutional resources, and he served as a communication link with other University administrative offices.

The study team was chosen by the Library administration, with the intention of getting diverse involvement and expertise. Library staff included the Associate Director, the head of Circulation, the serials cataloger and a reference librarian. Outside staff included the Director of the Division of Administrative Program Services, who furnished details on the Clemson computing environment, and an IBM marketing representative who provided appropriate help with hardware capabilities, the ATT methodology, and legwork. In addition, Clemson was also able to engage the help of a representative of IBM's Education Industry Division to guide the ATT efforts, on the basis of his experience in the use of the methodology.

Methodology

The Application Transfer Team methodology is applied in six phases.

The first phase involved an organizational session. Following the introduction of team members, the IBM Education Industry Division representative presented an overview of the methodology and explained the mechanics of the ATT study process. The team then established the scope of the study by determining the general objectives of the final system to be implemented. Since part of the purpose of the project was to develop a plan for Library-wide automation, it was quickly recognized by the team that the application area should be an integrated library information system. Since this scope was so broad it was determined that the team should concentrate on serials control. Since serials control is a single functional area, but encompasses nearly all bibliographic issues, it served as a microcosm of overall Library operations. Therefore, it was generally accepted that a system which effectively accommodated serials would constitute an integrated system plan. The organizational phase was concluded by determining who to interview during the data collections phase by establishing an interview schedule and by developing an outline of the final report.

The data gathering effort constituted phase two. This involved structured interviews of representative staff of each unit of the library who were involved in routine interactions with any phase of serials control at Clemson. Interviews were conducted with staff from acquisitions, cataloging, circulation, reference units and branch libraries as well as with the University Business Office, students and faculty. Each person interviewed was asked for specific details of his work with serial publications regarding (1) interfaces (or points of interaction), (2) concerns or needs, (3) suggested improvements, (4) expected values or benefits of improvements, and (5) work volume and (6) cycles. Data gathered in each of these interview sessions were immediately documented and reviewed by interviewees for corrections and added detail.

Data from completed and documented interviews were consolidated during the third phase of the study into a matrix of each of the six questions plotted against operational areas of the library, graphically designating areas of the greatest concern to the largest part of the library. This composite was analyzed to separate problems that could be reasonably handled by an integrated automation system from those that needed the attention of administrative policy and direction. Functions for automation consideration were then examined in a session of the committee in order to envision a system which would accommodate the specifications for serials control and access that each library unit and serials user required. From this session a synthesis emerged of the architecture for an integrated system.[4] This architecture included a description of the basic relationships of functional modules of the system, a list of the various files needed to contain system information, and a list of data elements required for bibliographic holdings, acquisition, and patron records in the system data base.

Phase four called for the translation of the architecture and general system requirements into modules on basic access, acquisition or processing functions, and into the individual programs needed to execute each module. One part of the ATT team listed the modules and programs and formulated descriptions of each. Part of the description effort involved drafting approximate flow charts of each program. Using algorithms developed by IBM, these descriptions were used to assign estimates of man hours required to create the necessary modules. In order to determine the overall cost of system development the man hour figures were converted to dollars by an average man hour cost for Clemson programming personnel.

Another part of the team evaluated anticipated benefits defined in the interviews, collected additional data from library staff to support these expectations, and assigned a value to each benefit. Benefits from reduced file maintenance and processing and tracking time were valued as man hours saved by the new system. Additional improvements were projected from the system's capability for better fund control, more complete and immediate on-order, claiming and in-process information, and statistical collection development/use data. These benefits were assigned a value based on an estimation of duplicates and inappropriate material acquired under the present manual system. A value was not assigned to user satisfaction which is intangible, and variable from case to case. Enhanced user service was recognized as a substantial benefit of the proposed system, but was not quantified. The cost factors determined in phase four were consolidated with derived benefit values to form a cost/benefit analysis, which constituted phase five.

In the sixth and final phase an implementation plan was formulated. This plan along with recommended target dates was presented orally to Library staff and University administration. In addition, the entire process, recommendations, and plan of action were documented in a written report.[2]

The report contained a description of the current library environment, objectives and description of the proposed system, implementation considerations, a cost/benefits analysis and recommendations for a plan of action. Although care was taken to "walk through" the function of each module of the described system, the report was not intended to provide detailed program specifications ready to be coded. It described a useful and powerful integrated serials system in sufficient detail to be a working tool in the hands of knowledgeable systems analysts to match (or revise) already available systems and programs to the library's specifications. The report itself also served as an effective communication link with the university administration, setting out library concerns and giving rational solutions to the pervasive problem of serials control and, in the long term, to an integrated library information system.

Evaluation

While it would have been appropriate at this point to turn the general design over to a systems analyst and programming staff to create detailed specifications, this was deemed inappropriate because of the reinvent-the-wheel phenomenon. There are numerous programs and systems in the academic area already in existence to support individual applications areas such as fund control and even entire library integrated systems. Instead, Library administration decided to thoroughly review existing systems in order to find the one most suitable for replication. It was realized that the existence of a system exactly suited to the needs of Clemson was unlikely. However, it was felt that there should be at least one system available for which modification would be substantially less than development from scratch. In order to find candidate systems and evaluate them, the Library called on an outside consultant to help develop a methodology.[3]

The evaluation methodology developed was essentially to use the general design criteria to create a linear model. The linear model consisted of a list of questions regarding features needed in a system capable of supporting the Clemson library and a list of hardware and software requirements. In addition, the model also required the creation of a list of development requirements and implementation costs for each candidate system evaluated. This evaluation phase proceeded in a series of steps which progress logically from one to another. Briefly listed these steps are:

- compile a list of general system requirements;
- compile a detailed list of features questions and hardware/software considerations;
- compile as exhaustive a list of candidate systems as possible;
- screen out the unsuitable candidates against the general requirements;
- evaluate the few candidate systems left with the detailed features questions;
- compile a list of development requirements for each based on the features analysis;
- list implementation, hardware, and software costs for each and total;
- summarize, compare and choose.

The list of general requirements was limited to a few basic needs, such as a requirement that any system be compatible with the Clemson computing environment or alternatively be stand alone and vendor maintained. In addition, at Clemson it was required that, at least two of the basic functional areas of the general design, such as serials control and acquisitions be available in the candidate system. It was also required that the source code be available. Once screened against these requirements, the heart of the analytical model which is the features analysis remained as the basic tool for isolating the best available system.

The features analysis consisted of a list of two hundred detailed questions derived from the general design requirements. To each of these questions a certain number of points were assigned by the evaluation team on the basis of a subjective determination of the relative importance of each feature. The number of points assigned in the Clemson case totaled over eight hundred. The underlying analytical model which was used was therefore, a linear one. In other words, the points which were assigned to each feature were added together in order to establish an overall score for the system. Thus, for example, if one system were to receive 5 points for feature "1" and 7 points for feature "2" and another system were to receive 7 points for "1" and 5 points for "2", the two systems would have the same total of 12 points.

In such a model the assumption is made that each of the points awarded are of equal weight and that they can be added together uniformly. Approximately the same model is used in most instructional situations in which course grades are given. That is, various tests, quizzes and papers are given different point totals to reflect their importance in relation to others. A person's performance on each is judged and a score given. An overall score is computed by adding together the individual scores, even though it is reasonably clear that understanding of a course is not a truly linear situation. Similarly, systems evaluation is not truly linear. Even so, because of several reasons, the linear model is extremely useful when applied carefully. First, by increasing the number of items which are considered, the importance of the score given to any individual item is reduced. Second, one can determine the sensitivity by reviewing the scoring results to determine the amount and type of change that would be needed in the scoring before there would be a change in the preferred system. The larger or more unusual the changes needed, the more confident one can feel that the linear model reflects the relative ordering of the capabilities of the systems. Third, one should compare the results of the computation with one's own subjective reactions to the systems being compared. If the scores do not give top rating to the system felt to be superior, it is desirable to investigate more closely by asking several general questions. Why is the system with the highest rating not the one which is prefered? Perhaps the concern is cosmetic; perhaps it is an important characteristic that was overlooked. Have all of the important characteristics of the system been identified and included in the comparison? Do the relative weights of the major feature groups reflect their importance to the application? Is there extraneous material in the comparison that is unintentionally overemphasizing areas which are not really that important?

In carrying out this followup work, it is not meant to suggest that one should "adjust" the ratings until the system isolated is the one desired in the first place. No indeed, the point is to investigate the differences thoroughly until one is convinced that a fair assessment is being made. When this is done, it is possible that the ratings will be changed and the original system will receive top marks. However, more often than not, it is the subjective evaluation that will be changed. The reason for this is that in most cases, the subjective evaluations are made with quite limited information about the alternatives. The much greater amount of information that is collected for a formal analysis usually reveals some surprises - capabilities which were assumed to be present which are not (and vice versa); capabilities which were assumed to be important which are not due to a different approach; and capabilities which were not originally considered which are important to successful operation. As a result, the importance of followup is to both improve the analysis and to become convinced of its adequacy. When this is done, it can be seen that any inherent problems with the underlying model are only of academic interest - the practical purposes of the model will have been met.

Each subsystem or feature area was analyzed by answering the detailed questions for each. Answers were awarded full points when the subsystem in question fully met the requirements implied and when it was operational. For cases where a subsystem was designed and coded or in test mode, only half the points were awarded. In other cases, judgements were made on how well requirements were met. When a subsystem was nonexistent or clearly did not meet requirements, no points were awarded.

Once points were awarded and totaled for features of each system the analysis was continued by answering a less extensive, but similarly detailed set of questions about general hardware/software considerations and costs.

Detailed estimates of implementation and development efforts were also listed. These estimates were made by professional assessments of the effort required to code those features determined as nonexistent during the features analysis. This data was finally summarized into a final decision table comparing three candidate systems in regard to initial cost, development person hours, elapsed implementation time, overall percent of features available, capability to network the system into the Clemson environment and the availability of serials control. Each of these elements was given approximately equal weight in the final decision process. The final recommendation carried with it a reasonable rationale supporting the final result as well as clear guidelines on development and implementation of a system.

Conclusion

The process summarized in this report took about nine months elapsed time which compares favorably with the time involved to develop specifications for a comparable system from scratch. However, at the end of that time the application area, in this case the library, was left with much greater assurance that plans and objectives would be met with a viable and effective product than is typical of other approaches. Also, the additional effort, cost and benefits were clearly laid out with substantially less design cost. And furthermore, there was enough involvement of library staff, systems people and outside suppliers to offset many of the educational problems and communication gaps frequently occuring as the result of traditional approaches.

Acknowledgement

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VENDOR PRESENTATIONS

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STRATEGIC PLANNING FOR INFORMATION TECHNOLOGIES IN EDUCATION

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Carolyn Barron, Administrative Products Manager
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EDUCATIONAL INFORMATION SYSTEM/DATABASE

Educational Information System/Database

The Educational Information System/Database (EIS/DB) Installed User Program 5796-BAZ, developed by James M. Upton, Director of Information Systems for an educational institution, forms the basis of a comprehensive information system for an institution of higher education. It links together eight physical, seven index and six logical databases containing thirty-eight physical segments and more than three thousand data elements into a single, integrated database structure, providing the foundation for a comprehensive educational information system. It offers the context in which a wide variety of programs may be implemented for such specific functions as curriculum development, class scheduling, student admissions, online and batch registration, student profiles, attendance, grading, and financial aid. EIS/DB makes it possible for the user to acquire or develop programs tailored to these specific functions and have them become part of a single, unified information system.

In addition to the databases, EIS/DB provides a set of Display Management System (DMS) panels known as "maintenance screens", which enable data processing personnel to create, display, modify and delete database information on a segment-by-segment basis. These screens serve the dual purpose of providing the application designer with an understanding of database contents, and establishing a means by which the data processing organization may correct erroneous data. A representative sample of "application" screens have also been included. These are intended for use by the system's end users and can serve as a model for further application development.

Another service provided by EIS/DB is called the Traffic Control Facility. This facility serves as a control point for the use of EIS/DB in the online environment and provides both security and ease-of-use features.

Systems Highlights and Features

The nucleus of EIS/DB consists of eight physical databases with seven associated primary and secondary index databases. The EIS/DB databases are as follows:

Program: Provides for program information at the branch level of the institution. Contains USOE, HEGIS and other codes together with program description and status fields.

Course: Provides for curriculum information at the highest administrative level of the institution. Multi-campus, multi-version and multi-title capability are available.

Employee: Provides information on all employees with particular attention to additional information on instructors as required by class schedule generation and reporting requirements.

Facility: Provides for facility information necessary for class schedule generation and reporting requirements.

Student: Provides for student information necessary for admissions, registration, grade reporting and institutional research.

Section/Class: Provides the focal point for the interaction of the other databases. The data access key has three major components: Term Prefix, Course I.D., Section I.D.

General Information: Provides for the establishment of institutional codes used by the system, and for control parameters governing the operation of programs.

User: Provides a basis for security within the system. Contains user identification, passwords and role definitions.

These databases define in excess of two thousand data elements essential in almost every institution of higher education.

Traffic Control Facility

The Traffic Control Facility (TCF) provides a comprehensive base for the operation of EIS/DB in the online environment. It establishes a central point for the purposes of managing the flow of user interactions ("traffic") within the system. TCF provides the following user interaction and database security functions:

- A user Sign-on/Sign-off facility
- An English-like command facility
- An active user list facility
- A command list facility

The user Command Facility is designed to enhance the flow of work through a DMS/CICS/VS system. It eliminates the need for elaborate menu structures, streamlines the screen-to-screen transition process, allows the user to issue commands in an English sentence-like manner and provides a portion of the database security facility.

Potential Benefits of EIS/DB

- High level data integration by means of a comprehensive data base structure
- Improved quality of information to support management decisions at all levels of the institution.
- Increased accuracy, timeliness of data through update and editing functions available to end user.
- Flexible access to data from many views using logical databases.
- Management of data as a system resource.
- Reduced database implementation time and effort by taking advantage of the development experience of others.
- Allows institution to develop or acquire application code to address specific needs and fit them into a single, unified structure
- Permits institution to take advantage of new and improved IBM software designed to interface with DB/DC products.

INTEGRAL
SYSTEMS, INC.

Corporate Headquarters
45 Quail Court
Walnut Creek, CA 94596
(415) 939-3900

On-Line Personnel Systems for Higher Education

Universities, like other organizations, need pragmatic solutions to human resource problems:

- Reducing staff turnovers
- Identifying and training replacements
- Forecasting staffing needs.

ISI provides the foundation for human resource planning through its fully-integrated, on-line, interactive, human resource information system. The Payroll/Personnel System includes the following components:

- Personnel Management
- Payroll
- Applicant Tracking
- Position Control

Personnel Management provides the ability to report the organizational reality:

- The employee population in terms of age, sex, race, job tenure, performance, and promotability.
- Historical changes including; hires, terminations, promotions, and transfers.
- Comparisons between the various organizational units in these respects.

Once these are determined the population data can be combined with employee-specific facts such as: performance ratings, promotability, succession planning data, and historical training and development information. From this, personnel managers can begin to address:

- The organizational strengths and weaknesses;
- employees who are ready for promotion and development; and,
- available replacements and training requirements.

An inventory of human resources is developed through the Personnel Management and Applicant Tracking components. From this inventory, skills, experiences, aspirations, and availability of individuals can be matched to the current and future needs of the organization. This is accomplished using information available within Position Control including: jobs that are or will be available; and the skills, experience and knowledge required.

This foundation will enable the organization to progress towards human resource planning and provide solutions to future personnel management problems.

MSA

THE FINANCIAL SOFTWARE COMPANY

Our principal business at Management Science America, Inc. (MSA) is to construct, install, and support a complete line of financial and human resource application software packages. We don't consider any job complete until the MSA system is live and operational. The quality of our systems, our personnel, and our ongoing program of customer support and system enhancement are all part of a total commitment to keep your system ahead of the field.

MSA supports your implementation and conversion through the participation of a highly qualified support team of installation and training experts who work on-site with your representatives. The MSA account representative assigned to your organization for the implementation process familarizes you with the system. You are introduced to the system documentation, the audio lessons, and the workbooks designed to serve as comprehensive learning aids. These materials guide the people who will use the system through each portion of it. At key points in this process, your MSA representative meets with your project team to conduct detailed training sessions and to answer questions.

MSA's systems are accompanied by extensive documentation organized both for your user and programming and data processing departments. The user documentation provides reference information on accounting and conversion procedures, a glossary of codes and terminology, control and balancing procedures, report formats, and instructions for completing all input forms. The system documentation includes file definitions, file retention guides, job control procedures, program cross-reference guides, device and pack requirements, flow and HIPO charts, and program narratives.

The MSA personnel behind MSA's systems represent MSA's continuing commitment to customer service and support. The focus is on "person to person" service-from the people at MSA to the people in the client organization. Using a variety of communication tools and media, MSA provides education, software enhancements, and day-to-day support for accountants, system professionals, and managers.

MSA's support staff includes accountants and CPSs experienced in the implementation of software systems in accounting environments. Educational programs designed for accountants in the client's environment include seminars, basic training, and special sessions on advanced techniques. MSA's regional offices throughout the world are equipped with online terminals to provide you with hands-on experience with MSA software.

When you need answers to specific questions you can reach your account representative by calling your MSA regional office. If the representative is unavailable, you can talk with a member of the client services staff. It is their full-time responsibility to handle your accounting and data processing questions about the system.

Workshops and training sessions are held in MSA's worldwide offices throughout the year providing you with basic, supplementary, and advanced instruction.

MSA's systems are sound, operational systems that were designed and written by experienced professionals, who continue to enhance the systems. Our General Ledger is one of the most widely accepted applications software systems in the world. More than 6,500 clients representing manufacturing, government, education and utilities use MSA systems. MSA is committed to making enhancements to all our systems to ensure that they are current with the latest accounting and regulatory guidelines, and, the latest data processing techniques.

The MSA General Ledger System offers many advantages to colleges and universities such as:

. Online encumbrance accounting
. The ability to account for Grants utilizing a fiscal year differing from the institutions.
. User controlled reports by responsibility structure as well as by fund.
. The ability to change functional or organizational structure without opening and closing accounts.
. The ability to produce all user defined reports with one pass of the General Ledger Master file.
. The ability to allocate indirect costs on selected statistical basis for calculation of indirect cost rates for grant administration.
. On line entry, inquiry and maintenance capabilities.
. The calculation of available funds for any budget category or account is updated with each online or batch entry to the General Ledger.
. The ability to use a user defined algorithm against current and historical financial and statistical data to provide an initial budget document.
. Realtime budget forecasting and planning through EASY-PLAN.™

MSA offers a set of systems that can be implemented separately but they can also function as a single unit. They are an integrated financial management system.

Human Resources

. Payroll
. Personnel
  . Position Control
  . Employee Benefits
  . Life to Date History
  . Lost Time/Health & Safety
  . Applicant Flow
  . Career Development
  . Labor Relations

Cash Management

. Accounts Receivable
. Accounts Payable
. Inventory and Purchasing

Financial Reporting and Forecasting

. Encumbrance Accounting
. Fixed Assets (Property Control)
. General Ledger
. Financial Forecasting and Modeling

For more information on how these systems can function in your institution call or write Robert Carpenter at Management Science America, Inc., 3445 Peachtree Road, N.E., Atlanta, Georgia 30326 or (404) 262-2376.

4401 West 76th Street, Minneapolis, MN 55435 / Phone 612-830-7600

NATIONAL
COMPUTER
SYSTEMS

SCANNING SYSTEMS DIVISION

DISTRIBUTED DATA PROCESSING

National Computer Systems has been in the business of providing highly accurate Optical Mark Reading systems for the education community for over fifteen years. These systems have been used for a wide variety of applications including: Testing, Grade Reporting, Attendance, Course/Faculty Evaluations, Surveys, Course Selection, Admissions, Payroll and Inventory.

Until recently, each of the Sentry OMR systems was designed for centralized data capture, with output going to tape. They all exhibited these key features:

1) Mini-computer based for immediate data editing
2) 16-level mark reading for unparalleled accuracy
3) Simultaneous two-sided read capability for large volume data collection
4) Unrestricted orientation of data grids for greater forms flexibility
5) Variable form size
6) Printing on the form after scanning for test results, error notations, or data control

To answer the need for distributed data processing and immediate data capture, NCS has announced the Sentry 7000 and 7001 OMR terminals. Both models have all of the characteristics of the larger members of the Sentry family, plus the ability to communicate directly to a host computer via telephone lines. A wide variety of communications protocols have been developed, to provide timely network installations

Colleges and Universities are showing an increasing amount of interest in the use of these OMR terminals for inclusion in their on-line registration systems. The throughput improvement over key entry of course selections is significant.

In summary, the NCS Sentry line of OMR systems range from centralized units that scan forms at 6,000 sheets per hour and output to tape, to distributed terminal units that scan at 500 sheets per hour or are hand fed. The terminal units are also capable of communicating with various micro-computers.

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Pansophic Systems, Inc.
709 Enterprise Drive
Oak Brook, Illinois 60521
312 986 6000

PANSOPHIC

Robert S. Briggs
Director of Agent Operations / National Accounts

(PROGRAM) LIBRARY CONTROL SYSTEMS (LCS)

At the December National Conference of CAUSE, Robert Briggs, Director of Agent Operations and National Accounts for Pansophic, and Dorothy Hopkin, Director of Administrative Data Processing for Michigan State University, joined forces in a presentation which covered the LCS concept and some experiences in the use of Pansophic products.

Briggs began his presentation with a discussion of the systems approach, geared toward serving program and executable program management. He reviewed the controls available for program security, auditor's facilities, change control and management visibility through reporting.

"The level of management experience in an installation will determine the key improvements that they wish to make," noted Briggs. He also pointed out that, like standards, security needs vary from shop to shop. "Security is really nothing more than standards enforcement. It does not mean simply putting passwords on data files, but is a specific set of procedures," Briggs explained.

Briggs was followed by Dorothy Hopkin, who shared some of Michigan State's experience in using Pansophic products with her audience.

"EASYTRIEVE has proven very successful for user's use," said Hopkin. "Because of it, we don't have to fill more simple requirements."

Hopkin said that Michigan State has 24 authorized user offices (of EASYTRIEVE) compared to approximately five user offices in the previous year.

"We went from an unmeasurable (insignificant) usage amount in June, 1980 to 5% of batch usage in June, 1981, said Hopkin. "We have formed an internal EASYTRIEVE users group because the use of EASYTRIEVE has gone so far."

Hopkin also discussed the use of PANAUDIT at Michigan State. "We bought PANAUDIT for ourselves, and our internal auditors," said Hopkin. "Our intent was that all auditors, not just EDP auditors, could use it--and they are still working toward that goal. We wanted it for sampling, to create test data, and for reporting off our systems management facility (SMF) data."

For further information about LCS and other Pansophic products, contact Robert S. Briggs, Director of Agent Operations/National Accounts, Pansophic, Systems, Inc., 709 Enterprise Drive, Oak Brook, Illinois 60521 (312-986-6000).

DATA PROCESSING SECURITY EVALUATION

Since more and more organizations are depending on computers to maintain their records, electronic data processing has become a vital part of operations. This trend, coupled with rapid technological advances, has increased the complexity of computer centers, as is evidenced by the use of large-scale computer hardware, communications networks, complex operating systems, and application systems designed with a high degree of sophistication using data-base techniques. The increased ability of computers to furnish a wide range of processing capabilities has brought about a high degree of centralization in both data and processing facilities. The total complexity and interdependence in a computer environment creates many opportunities for security threats.

Recently, situations involving computer misuse have made management acutely aware of the problems of computer security. Concern is being focused on the fact that an increased degree of risk has developed--without a corresponding increase in security standards.

Data Processing Security Evaluation (DPSE)

The purpose of the DPSE procedure is to determine the extent and adequacy of computer security. Based on the complexity of the data-processing environment and the need to be thorough and comprehensive, the DPSE guidelines are intended to aid PMM&Co. professionals and our clients in planning, reviewing, evaluating and improving the security of computer installations and their contents.

Although the review is designed for medium- to large-scale data-processing environments, the areas to which DPSE applies are appropriate to all computer installations. For any computer environment to be strong in the area of security, it must be strong in each of the segments of the review:

- Internal Audit
- Administrative Security
- Physical Security
- Standards
- Processing Security
- Operating System Security
- Software Security
- Data Base Security
- Communications Security
- Applications Security

The evaluation of each of the above areas is quantified on the basis of the review procedure and a scoring methodology. The intent is not to provide a means of measuring the degree of security at one data center against another, but rather to highlight the areas of exposure in order that measures for security improvement can be initiated. Improvement programs, and their associated costs, can now be balanced against the risks involved with continued exposure. This risk-analysis procedure provides management with a sound basis upon which to make decisions with a security impact.

DPSE Benefits

Clients with sophisticated data-processisg operations can derive significant benefits from the DPSE approach. In addition to the fact that the evaluation is independent and objective, the recipient also benefits in the following ways;

- The client now has a real indication of what aspects of the data-processing organization are strong and what areas are weak with respect to security.
- The implications of security weaknesses can be identified during the review and considered in management's future decision-making.
- DPSE can provide the basis for a comprehensive risk-analysis program where the costs associated with improving computer security can be weighed against the degree of exposure to the continued weakness.
- DPSE provides the client with the information necessary to insure the safety and integrity of the sensitive data and the physical facilities in which those data are stored.
- DPSE provides client management with the assessment of the effects upon the organization of a major data center disaster and how well a recovery from that disaster could be executed.
- The degree of security awareness in client organizations is improved as a result of the comprehensive DPSE methodology being applied throughout the organization.
- Client management can gauge the progress of data-processing security in the organization from year to year by applying the DPSE guidelines on an annual basis either through PMM&Co. assistance or through the organization's own internal audit staff.

Contact

For individuals requiring more DPSE information, contact Ms. Claire Reid, Peat, Marwick, Mitchell & Co., 345 Park Avenue, New York, New York, 10154, or call Ms. Reid at (212) 872-5969.

SCT SYSTEMS OF THE EIGHTIES

Integrated Student Information System (ISIS)

To provide needed student-related data, SCT designed its on-line Integrated Student Information System (ISIS). ISIS collects, processes, stores, retrieves, and reports demographic, biographic, academic history, and student financial data. It maintains all student information on pre-applicants through continuing and recently-enrolled students. Using a common data base, it facilitates record modifications and optimizes reporting capabilities to insure convenient, accurate services to students and administrators, reduces clerical work, and provides more timely, efficient processing of student information.

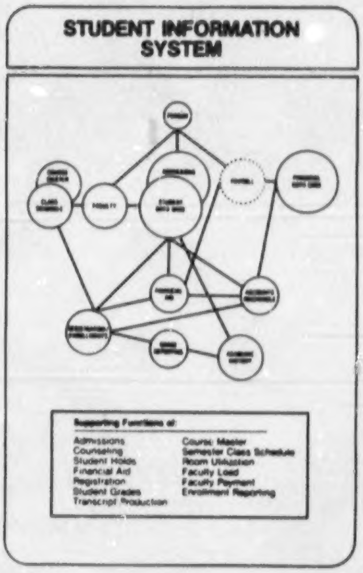
System modules are completely compatible in order to provide the proper integration between student system components and related accounting system components. Together, they work to establish a base of data. The system is designed for maximum data security to prevent illegal or unauthorized access. It also maintains data within a set of user-defined parameters and provides for the archiving of data. All transactions are retained for audit and recovery purposes.

The unique SCT information system further provides an audit trail for verification of changes, as well as back-up files for recreation or recovery in case of loss of files being processed.

As a fully integrated on-line system, it provides a single source of data, allows maximum access while optimizing updating capabilities, and organizes modules (terminal screens) by adminstrative functions.

ISIS meets the functional requirements of each client institution through a series of modular subsystems, each relating to specific administrative needs. As a result, this sophisticated computing resource can act as the official source of student information for use by most administrative services offices, including:

- Admissions, Registration, and Records;
- Advisors and Counselors;
- Accounting and Business Offices;
- Deans, Department/Division Heads and Faculty;
- Financial Aid and Veterans Offices;
- Educational Planning and Research.



Human Resources Information System

The Human Resources Information System is made up of three subsystems which comprehensively address the management and administration of personnel and the personnel services budget for the institution. The three functional interrelating components, consisting of position/budgeting control, personnel, and payroll, provide automated support that can expedite all information processing and reduce errors in repetitive clerical tasks associated with these key functions. All components are integrated and on-line, supporting immediate data entry and information retrieval and provide consistency of data by utilizing a single data base for the storage of all employee information.

Payroll

The Payroll subsystem provides information processing capabilities in the areas of time collection/balancing, check creation, and reconciliation, payroll adjustment, and labor distribution, among others.

Concurrently, exception and/or positive time reporting by individual position/employee class is supported. Capabilities also include the ability to process variable contract lengths—e.g., work ten months, pay twelve months. The subsystem accommodates one-time payments, special rates per course or contact hour, overloads, retirement payoff, etc. Each unique payment may be taxed utilizing separate taxation criteria and automating the calculation of gross pay, deductions, taxes and net pay.

Time Recording and Payroll Adjustment processes are on-line. Further, "Pay Events" (checks and adjustments, for example) are maintained on-line for a client-specified period to facilitate reference in the event of inquiry. Extensive payroll reporting is provided, including: time sheet proof, payroll calculation exceptions, checks, direct deposit notices, check register, payroll register, benefit/deduction register, benefit/deduction enrollment reports, W-2 and tax reports, and labor distribution reporting.

Position Budgeting/Control

The Position Budgeting/Control subsystem provides the institution with an on-line capability for the creation and maintenance of the personnel services budget. It automatically updates expenditure data against budgeted positions and the resultant status and balances are immediately available on-line. Extensive reporting capabilities, including the ability to generate authorized position rosters to assist in the recruiting process and expenditure reports which highlight non-budgeted and over-budgeted expenditures, are a part of the system.

Personnel

The Personnel subsystem provides the institution with on-line support for personnel functions and a method for data collection and maintenance for personnel actions, including applicant processing, hire/rehire, assignment/appointment, leave of absence, sabbatical, and termination.

This subsystem features comprehensive reporting capabilities, including the ability to generate traditional personnel reports, such as Pending Action Lists, Pending Employee Reviews, Bargaining Unit Census, Employee Leave Accounting, Benefit/Enrollment, Maintenance Activity reporting and Telephone Directory. More recently, required reports such as EEO, Affirmative Action, and Benefit Profiles, are also produced.

Budget Preparation System

The Budget Preparation System is an on-line interactive system designed to increase the efficiency of the budget development process. The system provides operating departments with the ability to enter and update their budget requests for the next fiscal year via terminal. This process eliminates the time consuming batch processing of the budget worksheets which typically occurs. The Budget Office is relieved of the burden of manually assembling the budget and can focus its efforts on the control of the budget.

The system provides for the automatic calculation of fringe benefits as a function of requesting labor budgets thereby eliminating the need to manually calculate and input fringe benefits. In addition, price changes for inflation are computed by the system, thereby insuring consistent application of inflation percentages across organizational boundaries.

To monitor the progress of the development of the budget, departments may query the status of their budget via terminal. Also, the Budget Office may query the status of overall budget requests versus previously determined allocations.

System Overview

The development of next fiscal year's budget by sub-object consists of two processes:

- Allocation of resources to major operating units
- Requests for funds by budget unit heads

Allocation of Resources

At the start of the budget development process, the Budget Office enters allocations previously determined by management. Allocations of current general funds are entered by major operating unit (level 1 organization) and program (level 1 program). In some cases, expenditures are entered in unique categories rather than program, e.g. equipment, sabbatical leave and reserves. The allocations are entered via terminal, and the allocation programs and categories are fixed on the screen. As detail budgets by sub-object are entered into the system, they are posted to the appropriate allocation. The Budget Office and major operating unit can inquire via terminal to display the status of each allocation. Information shown includes current year budget, next year requested, next year allocations, and variances.

Budget Developed by Sub-Object

To assist the budget unit heads in requesting funds for the next fiscal year, a worksheet is generated from the Fund Accounting System showing the current status of the budget by organization, program, fund, and sub-object. Budget unit heads enter requests for the next fiscal year on these worksheets. These data are entered at each site via terminals. The system provides an inquiry capability to display the status of an individual organization budget by program, fund and sub-object. As the budget is modified and changed, additional worksheet reports are provided to input additional requests and to display the current status. To support the analysis of the budget at various management levels within the institution, various hierarchical reports are generated which provide a comparison with the request for the current year budget.

Price Changes

The budget is developed by the major operating units in terms of current year dollars. Once the Budget Office has determined that the budget process is essentially complete, price changes are applied to recognize inflation, etc. Price changes are applied on a percentage basis by major operating unit and sub-object. Once the price changes are applied, they appear in a separate column on the various budget reports. Price changes may be applied more than once; each application will replace previous amounts.

Calculation of Fringe Benefits

As sub-objects for salaries and wages are entered into the system, fringe benefits are calculated and incorporated into the budget. The calculation is based on a percentage which is unique to each salary sub-object. All benefits are recorded to a single sub-object within organization, program and fund.

Interface with the Fund Accounting System (FAS)

Once the budget has been finalized, an interface file to the Fund Accounting System is generated containing budget transactions which are used to record the budget in FAS. Subsequent adjustments to the new current year budget are made directly to FAS.

Fund Accounting System

The Fund Accounting System (FAS) is a comprehensive accounting system which emphasizes financial control and expenditure reporting by organization, program, and account. It is the nucleus of the institution's financial management system and, as such, receives much of its input from "feeder systems. This input may be entered either manually or via computer compatible media from existing automated systems. FAS maintains the official "books" and generates financial statements for both internal management and external reporting. This double entry accounting system keeps a self-balancing set of accounts for major fund groups, including current restricted and unrestricted funds, loan funds, endowment funds, annuity and life income funds, plan funds, and agency funds.

In providing the institutions with financial reports and statements, these reports are based on a flexible fund hierarchy which enables the system to aggregate financial activity from the low level fund, to the fund subgroup, to the high level fund group. The system provides complete grant and project accounting based on the assignment of fund numbers.

FAS operates as an integrated subsystem, thereby eliminating the problems that exist in independently developed software packages—problems including the requirement to manually reenter data because the systems are incompatible; problems associated with the inconsistent reporting of similar data maintained in different systems; or those problems likely to be encountered when reconciling discrepancies among the subsystems. Its major features include on-line inquiry, comprehensive reporting, hierarchical coding schema, budgetary and encumbrance control, complete audit trails, system reconciliation, system tables, single transaction input, one-sided entry and comprehensive transaction validation.

**Westinghouse
DataScore Systems**

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University of Illinois Case Study

Installation of the

Westinghouse Information Associates Financial Accounting System

Overview:

Westinghouse invited the University of Illinois to present an overview of the installation of the Westinghouse Information Associates Financial Accounting System. With much preliminary planning, the University signed an agreement in March of 1980 to implement this system for live use beginning in July, 1981. This schedule was met and the University has been live now for five months.

This session, given by Mr. Richard Margison, Associate VP for Business Affairs (U of I), Mr. David Snyder, Associate Director, Business Management Systems (U of I), and David McKelvey, Manager of Product Support (Westinghouse), provides a summary of the planning process that the University went through to prepare for a new Financial Accounting System, the approach taken for project installation, and finally, some benefits the University is planning to derive.

Characteristics of the University of Illinois:

The UI consists of three major campuses: Chicago Circle, a non-resident urban facility for 20,000 students; the Medical Center, also in Chicago (and with satellite facilities in Rockford and Peoria), which includes nursing and dentistry for 5,000 students; and Champaign Urbana, the flagship facility for 35,000 students.

The annual budget is over $760 million with approximately half coming from state funds, $100 million in federally-sponsored research, $80 million in auxiliary services, $80 million in hospital operations and the remainder in tuition, gifts, and other miscellaneous activities.

The institution is managed by a strong central administration that has financial recordkeeping responsibility for all campuses. As such, the central administration has staff on each campus under a Business Director of Affairs who, in turn, reports to the Associate Vice President for Business Affairs.

The University has one large central computer center for all administrative systems (AMDAHL V8, IMS DB-DC many terminals) located in Chicago with high speed transmission to each campus.

System Requirements:

In 1978 the University established a steering committee representing all University segments to develop a requirements document for a financial system to meet the growing needs of the 1980's and beyond.

The objective of this project was to incorporate all three campuses and the general administration into one financial accounting system with a common data base, operating on the administrative computer facility. Data was to be independently entered from various remote locations with diagnostics routed back to those entry points. Monthly reporting was to be accomplished at one time, but to each campus for distribution. These goals accomplished, the University would dramatically simplify intercampus transfers, state interfaces, external and internal reporting, and University-wide financial analysis. Results would be more timely and with a stabilized accounting office workforce.

Project Installation Planning:

A core group was convened to present the needs to University management with the following observations. We do not have the resources in-house or the time to develop this on our own. If we can find at least an 80% solution, we can adjust people and procedures to accomplish the other 20%. We need to be live at the start of a fiscal year (e.g., July) and need at least 12 months (probably more to do it).

With approval, a selection committee of 15 people was formed. A requirements document was developed. Two vendors were invited to the University twice each to discuss their offerings. Probably the most important criterion for selection in the final analysis was the experience with large universities over an extended period.

The implementation team consisted of 26 UI personnel and 5 WIA personnel. Intensity for any one person throughout the project varied from 20%-100% of his/her time.

After the design sessions, this group then became the trainers of the trainers. A long-term commitment had been made to training. Several operations manuals were developed covering System Overview, new procedures, and annotated reports. Literally hundreds of seminars were conducted for groups of up to 25 people throughout the spring on all campuses. Many of these classes were given by departmental business managers after they had been trained by the core group. This proved very effective and a reflection of the campus commitment. Communication can never be underestimated. A monthly newsletter was established. It had a distribution of 4700 copies.

This system went live July, 1981. Once this core financial system has been absored, the University intends to analyze and improve each of the feeder subsystems. From 1978, the whole process is intended to require six to eight years. Progress to date has been exceptionally fine.

BUSINESS AND PLEASURE

Ideas are exchanged as readily during breaks between sessions as they are at formal track presentations. An important part of the Conference experience are the social gatherings — those that are scheduled as official Conference activities as well as those that occur spontaneously as new friendships are formed and old acquaintances are renewed.

The 1981 Conference featured the CAUSE Anniversary Banquet in honor of the organization's 10th anniversary. The evening of nostalgic festivities included a brief program commemorating the contributions of past CAUSE presidents and the growth of CAUSE since its incorporation a decade ago.

REGISTRATION RECEPTION

REFRESHMENTS

Special thanks to Integral Systems, Inc. and National Software Enterprises, Inc. for sponsoring refreshments.

BREAKS

ANNIVERSARY BANQUET

CAUSE 81

CAUSE 81